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U. S. DEPARTMENT OF AGRICULTURE.

BUREAU OF PLANT INDUSTRY—BULLETIN NO. 48.

B. T. GALLOWAY, *Chief of Bureau.*

THE APPLE IN COLD STORAGE.

BY

G. HAROLD POWELL,
ASSISTANT POMOLOGIST IN CHARGE OF FIELD INVESTIGATIONS,

AND

S. H. FULTON,
ASSISTANT IN POMOLOGY.

POMOLOGICAL INVESTIGATIONS.

ISSUED DECEMBER 3, 1903.

WASHINGTON:
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1903.

BULLETINS OF THE BUREAU OF PLANT INDUSTRY.

The Bureau of Plant Industry, which was organized July 1, 1901, includes Vegetable Pathological and Physiological Investigations, Botanical Investigations and Experiments, Grass and Forage Plant Investigations, Pomological Investigations, and Experimental Gardens and Grounds, all of which were formerly separate Divisions, and also Seed and Plant Introduction and Distribution, the Arlington Experimental Farm, Tea Culture Investigations, and Domestic Sugar Investigations.

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[Continued on p. 3 of cover.]

SCALD ON YORK IMPERIAL APPLES.

U. S. DEPARTMENT OF AGRICULTURE.
BUREAU OF PLANT INDUSTRY—BULLETIN NO. 48
B. T. GALLOWAY, *Chief of Bureau*

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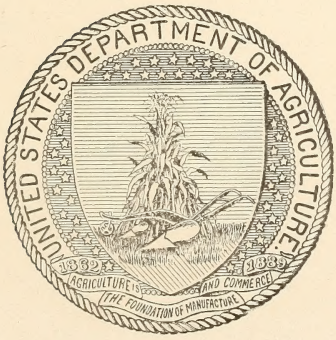

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1903.

BUREAU OF PLANT INDUSTRY.

BEVERLY T. GALLOWAY, *Chief of Bureau.*

POMOLOGICAL INVESTIGATIONS.

SCIENTIFIC STAFF.

G. B. BRACKETT, *Pomologist.*

WM. A. TAYLOR, *Pomologist in Charge of Field Investigations.*
G. HAROLD POWELL, *Assistant Pomologist in Charge of Field Investigations.*
H. P. GOULD, *Assistant Pomologist in Charge of Fruit District Investigations.*
GEORGE C. HUSMANN, *Expert in Charge of Viticultural Investigations.*
S. H. FULTON, *Assistant in Pomology.*

LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Bureau of Plant Industry,
Office of the Chief,
Washington, D. C., June 18, 1903.

Sir: I have the honor to transmit herewith a paper entitled "The Apple in Cold Storage," and respectfully recommend that it be published as Bulletin No. 48 of the series of this Bureau.

This paper was prepared by Mr. G. Harold Powell, Assistant Pomologist in Charge of Field Investigations, and Mr. S. H. Fulton, Assistant in Pomology, and has been submitted by the Pomologist with a view to publication.

The illustrations which accompany this report, consisting of five colortypes and one half-tone plate, are considered essential to a full understanding of the text.

Respectfully,

B. T. Galloway,
Chief of Bureau.

Hon. James Wilson,
Secretary of Agriculture.

PREFACE.

Apple culture has attained such proportions in the United States that the harvesting and disposition of the crop have become matters of national importance. A general failure of the crop of winter apples in any season results in serious disturbance of commercial conditions in many important agricultural regions and involves heavy losses to mercantile and transportation interests, as well as to the growers. At the same time it inflicts a serious hardship upon consumers by depriving them of this the most useful fruit in their household economy.

Next to crop failure and the control of injurious diseases and insects, the most important feature of commercial apple growing at the present time is undoubtedly the preservation of the crop for a sufficient time to permit its distribution to consumers in sound and wholesome condition, in both home and foreign markets, throughout the winter season. This feature has become very prominent since apple orcharding has developed on a large scale in the middle and more southern States, where the climatic conditions at the time of the apple harvest are frequently unfavorable to long durability of fruit. Under the deteriorating influence of warm weather during September and October a large part of the crop frequently reaches full ripeness and is thrown upon the market in perishable condition before midwinter. This results in disastrous gluts and ruinously low prices for a time, followed by scarcity of fruit and abnormally high prices to the consumer in the late winter and early spring.

The successful keeping of apples on a large scale in refrigerated storage, which began about 1890, was welcomed by growers and dealers as a solution of the problem, and the practice of storing in this way has since developed to very large proportions. Experience has demonstrated, however, that in many instances fruit stored in such houses in the fall has failed to come out in good condition in the late winter or spring, to the serious loss of the owner. It has long been observed also that different lots of fruit in the same storage room behave differently, some keeping in excellent condition, while others spoil. A browning of the skin of the apple while in storage or shortly after removal therefrom, generally known as "scald," also frequently lessens the beauty of the fruit and therefore its selling value, even when its food value is but little impaired.

In investigating this subject with a view to reducing the uncertainty and the loss, it has been found necessary to take up the entire question of orchard location and cultural treatment, as well as the methods employed in picking, packing, and shipping the fruit, all of these having important bearing on the durability of the product after it reaches the storage house. Systematic work along these lines was begun in the autumn of 1901 and has been continuous since that time. The problems involved are so complex and varied in view of the large number of varieties now commercially grown and the wide range of climatic and soil conditions involved that accurate and comprehensive generalization of results will require several repetitions of most of the experiments. Certain discoveries of distinct economic importance have been made during the progress of these investigations which appear to render the publication of this preliminary report advisable at this time in order that they may be available for application to the handling of the crop of the current season.

The investigation referred to has been conducted and this bulletin prepared by Mr. G. Harold Powell, Assistant Pomologist in Charge of Field Investigations, and Mr. S. H. Fulton, Assistant in Pomology, under the direction of Mr. William A. Taylor, Pomologist in Charge of Field Investigations. While the experimental work of the Department has covered but two seasons, the experience of many of the leading cold-storage men of the country has been drawn upon and freely given. It is therefore believed that the bulletin in its present form affords a safe guide in the matter of winter-apple storage in refrigerated warehouses.

G. B. Brackett,
Pomologist.

Office of Pomological Investigations,
Washington, D. C., May 29, 1903.

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THE APPLE IN COLD STORAGE.

INTRODUCTION.

The application of cold temperatures to the preservation of fruits has profoundly influenced the development of American fruit growing. When orchard products had to be transported to market in common freight cars and express cars or by boats running on slow schedules, and the surplus fruit was stored in cellars, pits, and fruit houses without artificial cooling, it was necessary to dispose of the crop quickly in local markets to prevent unusual losses from decay. Ever under the most favorable conditions, the markets were often oversupplied in the fall months, with an accompanying demoralized condition in the fruit trade, especially when the weather was hot, while the supply of fruit was exhausted early in the winter and the markets were barren during the remaining season.

The development of the fruit-refrigerator-car service and other improved methods of transportation have made fruit growing possible in remote parts of the country and have facilitated the wide distribution of the most perishable products. Mechanical refrigeration on shipboard and the introduction of other special facilities for fruit transportation are extending the markets for fresh fruit abroad. The growth of the cold-storage warehousing business is making the season of fresh fruits and vegetables perennial. It is distributing them more uniformly throughout the season and is thereby contributing to their freer use, to more steady markets and uniform prices, and to a more stable fruit business.

INFLUENCE OF COLD STORAGE ON THE APPLE INDUSTRY.

Cold storage is having an important influence in developing the apple industry as a stable business. Instead of an incidental feature of the general farm, the apple is now the principal crop in large sections of the country, and its production and the handling and marketing of the crop are becoming highly specialized forms of agriculture and of trade.

Formerly the marketing of the crop was largely controlled by the apple grower, but now the growing of the crop and its sale are rapidly

differentiating into two distinct lines. In many of the principal fruit-growing districts the handling of the crop and its marketing are controlled largely by fruit organizations or by apple merchants who buy the fruit in the orchards and who, through the special development of fruit and market statistics, are better able than the fruit grower to regulate its distribution and sale. This greater stability and specialization in apple growing is accompanied by a large amount of speculation. Through a combination of the buyers the fruit may not always sell in the orchard for its real value, but on the other hand the severe competition in buying in those sections where the industry is especially well developed frequently brings the grower the highest prices.

Apple storage is not always profitable. It is an insurance against the premature deterioration of the fruit, but when the picking season is unusually hot and there are delays in getting the fruit into storage, the subsequent losses are sometimes very heavy. On the other hand the autumn may be unusually cool and favorable for storing large quantities of apples in common storage. As a result the markets are well supplied with this fruit through the winter, causing the cold-storage stock to be held back till late in the season, when it has to be rushed on the market and sold at a sacrifice on account of the approaching warm weather and the free use of southern early fruits.

On the whole the development of the cold-storage business is proving beneficial to the apple industry in encouraging the development of apple growing over large territories, in making the investment of capital in it safer, in developing it as a highly specialized type of agriculture and trade, and in making a valuable food product available to an increasing number of people over a greater part of the year.

THE EXTENT OF THE COLD-STORAGE WAREHOUSING INDUSTRY.

The magnitude of the cold-storage warehousing business and its importance to the fruit industry are not generally recognized. Accurate statistics are difficult to obtain, but in 1901 it was estimated[a] that the capacity of the cold-storage warehouses, including meat, egg, and butter storage, was 150,000,000 cubic feet of space, of which 50,000,000 cubic feet, distributed in 600 houses, were devoted to fruit storage. Since 1901 there has been a large increase in the number of fruit-storage houses, especially in the apple-growing districts, where many plants, with a capacity of 5,000 to 30,000 barrels, have been erected in or near the orchards or at the railroad stations.

The cold-storage business has developed most extensively in the large cities and in towns conveniently located for distributing the fruit later in the season to domestic or foreign markets.

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[a] Bul. Amer. Warehouseman's Ass'n, Nov., 1901, ex N. Y. Sun.

The following table[a] gives a list of the cities and towns in which more than 75,000 barrels of apples were stored about December 1, 1902:

Cities and towns in which more than 75,000 barrels of apples were held in cold storage about December 1, 1902.

Place.	Number of barrels stored.	Place.	Number of barrels stored.
Chicago, Ill	431,700	Boston, Mass., and vicinity	102,000
New York, N. Y	200,000	Indianapolis, Ind	100,000
Philadelphia, Pa., and vicinity	200,000	Leroy, N. Y	100,000
Rochester, N. Y	150,000	Brighton, N. Y	90,000
St. Louis, Mo	120,000	Lockport, N. Y	90,000
		Albion, N. Y	86,000

The extent of the apple-storage business in States in which more than 100,000 barrels were stored about December 1, 1902, is shown in the following table:[a]

States in which more than 100,000 barrels of apples were held in cold storage about December 1, 1902.

State.	Number of barrels stored.	State.	Number of barrels stored.
New York	967,000	Ohio	135,800
Illinois	524,400	Massachusetts	118,000
Missouri	327,000	Indiana	107,500
Pennsylvania	220,000		

Large quantities of apples are still stored in cellars and common storage houses, especially in New York and in the New England States. The extent of this phase of the storage business in States storing 75,000 barrels or more about December 1, 1902, is given in the following table:[a]

Apples in common storage about December 1, 1902.

State.	Number of barrels in common storage.	State.	Number of barrels in common storage.
New York	474,000	Massachusetts	100,000
Maine	240,000	Vermont	75,000
New Hampshire	123,000		

[a] Statistics furnished through the courtesy of the National Apple Shippers' Association.

The magnitude and growth of the apple-storage business as a whole may be better appreciated by reference to the accompanying table, which represents the number of barrels held in the United States both in cold and common storage about December 1 each year since 1898:[a]

Apples in storage about December 1, 1898–1902.

Date.	Barrels in cold storage.	Barrels in common storage.	Date.	Barrels in cold storage.	Barrels in common storage.
1898.....	800,000	400,000	1901.....	1,771,200	138,000
1899.....	1,518,750	634,500	1902.....	2,978,050	1,236,750
1900.....	1,226,900	794,000			

The approximate number of barrels stored in Canada and Nova Scotia on December 1, 1902, was 437,200 in common storage, and 32,800 in cold storage.

THE FUNCTION OF THE COLD-STORAGE WAREHOUSE.

There is a good deal of misapprehension as to the function of a cold-storage house in the preservation of fruits. This condition leads to frequent misunderstandings between the warehouseman and the fruit storer, though they might be avoided and the condition of the fruit-storage business improved if there was a clearer definition of the influence on fruit preservation of cultural conditions, of the commercial methods of handling, and of the methods of storage.

A fruit is a living organism in which the life processes go forward more slowly in low temperatures, but do not cease even in the lowest temperatures in which the fruit may be safely stored. When the fruit naturally reaches the end of its life it dies from old age. It may be killed prematurely by rots, usually caused by fungi which lodge on the fruit before it is packed, or sometimes afterwards. The cold-storage house is designed to arrest the ripening processes in a temperature that will not injure the fruit in other respects and thereby to prolong its life history. It is designed also to retard the development of the diseases with which the fruit is afflicted, but it can not prevent the slow growth of some of them. It follows that the behavior of different apples or lots of apples in a storage room is largely dependent on their condition when they enter the room. If they are in a dissimilar condition of ripeness, or have been grown or handled differently, or vary in other respects, these differences may be expected to appear as the fruit ripens slowly in the low temperature. If the fruit is already overripe, the low temperature can not prevent its deterioration sooner than would be the case with apples of the same variety that were in a

[a] Statistics furnished through the courtesy of the National Apple Shippers' Association.

less mature condition. If the fruit has been bruised, or is covered with rot spores, the low temperature may retard but can not prevent its premature decay. If there are inherent differences in the apples due to the character of the soil, the altitude, and to incidental features of orchard management, or variations due to the methods of picking, packing, and shipping, the low temperature must not be expected to obliterate them, but rather to retard while not preventing their normal development.

In general it is the function of the cold-storage warehouse to furnish a uniform temperature of the desired degree of cold through its compartments during the storage season. The warehouse is expected to be managed in other respects so that the deterioration of the fruit or any other injury may not be reasonably attributed to a poorly constructed and installed plant, or to its negligent or improper management. The warehouseman does not insure the fruit against natural deterioration; he holds it in storage as a trustee, and in that relation is bound to use only that degree of care and diligence in the management of the warehouse that a man of ordinary care and prudence would exercise under the circumstances in protecting the goods if they were his private property.

If the temperature of the storage rooms fluctuates unduly from the point to be maintained and causes the fruit to freeze to its injury, or to ripen with abnormal rapidity, or if the management of the rooms or the handling of the fruit in other respects can be shown to have been faulty or negligent, the warehouse has failed to perform its proper function.

PRINCIPLES OF MECHANICAL REFRIGERATION.

Refrigeration, or cold storage, as applied to warehouses, is usually produced by the evaporation of a liquefied gas, which in evaporation absorbs the heat from its surroundings, thereby lowering the temperature. The refrigerating gases generally used are anhydrous ammonia, sulphurous acid, and carbonic acid (also known as carbon anhydrid and carbon dioxid). The cold temperature in the warehouses is usually produced by either of two methods, commonly known as the compression and the absorption systems.

The compression system takes its name from the fact that the refrigerating gas—whether ammonia, carbonic acid, or sulphurous acid—is first compressed in a machine called a compressor. Heat is generated by the compression; the gas is then cooled and condensed in pipes or coils called the condenser, either immersed in water or having water running over them, and this converts the gas into a liquid. The liquefied gas then passes an expansion valve to pipes or coils called the refrigerator cooling coils or cooler, where it is evaporated by the heat which is withdrawn from the surroundings. The gas formed by the

evaporation of the liquid returns to the compressor, is again condensed, then reevaporated, and the cycle of refrigeration is repeated over and over.

In the absorption system the gas is obtained by heating strong aqua ammonia in a still, thereby driving off the ammonia gas. The gas is then reduced in a condenser to a liquid in a manner similar to the compression system. The liquefied ammonia produces refrigeration by evaporating in the cooling coils, and the gas is then absorbed by weak aqua ammonia in coils called an absorber. The resulting strong liquor is then pumped back to the still. The cycle of refrigeration is repeated continuously, and consists, first, in the generation of a gas by heating strong aqua ammonia in a still; second, in condensing the gas which is deposited from the water to a liquid in the condenser coils; third, in its evaporation to a gas in the cooling or refrigerator coils; fourth, in its absorption by the weak aqua ammonia in the absorber; and fifth, the ammonia liquor is piped to the still and redistilled.

THE UTILIZATION OF THE COLD TEMPERATURES.

There are three general methods of producing the desired temperatures in cold-storage rooms, and these are known as the direct-expansion, the brine-circulating, and the indirect or air-circulating systems. All three systems may be used in a cold-storage plant, and in a given room or compartment the air-circulating system is sometimes used in connection either with the brine or the direct-expansion systems.

THE DIRECT-EXPANSION SYSTEM.

In the direct-expansion system the liquefied gas evaporates directly in the cooling refrigerator coils or pipes which are placed in the refrigerator rooms. The heat used in the evaporation of the gas is absorbed from the room or from its contents, and the temperature is thereby reduced. The gas then returns to the compressor in the compression system, or to the absorber in the absorption system, and after being distilled in the latter case begins the refrigerating cycle anew.

THE BRINE-CIRCULATING SYSTEM.

In the brine-circulating system, the liquefied gas, instead of evaporating directly in coils in the storage room, evaporates in pipes surrounded by brine, or in a brine cooler. The heat used in the evaporation of the gas is absorbed from the brine rather than from the room and its contents, as in the direct-expansion system. The cold brine is then pumped to coils in the storage room and the heat of the room and its contents is absorbed by the cold brine. The warm brine is then returned to the tank or cooler from which it started and is recooled, while the gas returns to the condenser or to the absorber to renew the cycle of refrigeration.

THE AIR-CIRCULATING SYSTEM.

In the indirect or air-circulating system the air in a well-insulated room, which is sometimes called a coil room or a "bunker room," is first cooled, either by the direct-expansion or by the brine-circulating system. The cold air of the coil room is then forced through ducts to the storage rooms. After passing through the storage rooms it is returned by ducts to the coil room to be recooled and purified and to begin the circuit anew.

There are many modifications in the details of these systems when applied to storage houses, but as this publication does not deal primarily with the engineering side of refrigeration it is the purpose to set forth approximately the fundamental principles on which the most common storage systems are based rather than to discuss their application or their respective merits.

OUTLINE OF EXPERIMENTS IN APPLE STORAGE.

An outline of the apple storage experiments of the United States Department of Agriculture is presented here. The following problems have been under investigation during two apple seasons:

(1) A comparative test of the keeping quality of a large number of varieties grown in different regions and of the same varieties grown under different conditions and in different localities.

The fruit has been stored in closed 50-pound boxes in a temperature of 31° to 32° F. One-half of the fruit in each box has been wrapped in paper.

(2) A determination of the influence of various commercial methods of apple handling on the keeping quality of the most important varieties in the leading apple-growing regions of the eastern United States.

Each variety has been picked at two different degrees of maturity: First, when nearly grown but only half to two-thirds colored, or about the time when apples are usually picked; second, when the fruit was fully grown and more highly colored, but still hard. In each picking the fruit was separated into two lots, representing the average of the lightest and of the darkest colored or most mature specimens.

Part of the fruit of each series was sent to storage as soon as picked. A duplicate lot was held two weeks in the orchard or in a building, either in piles or protected in packages, before it was sent to storage.

Comparative tests have been made to determine the efficiency of different kinds of fruit wrappers on the keeping of the fruit, and observations on the behavior of the fruit in closed and ventilated packages have been recorded.

(3) A determination of the influence of various cultural and other conditions of growth on the keeping quality of the fruit.

Comparison has been made with the same variety from heavy clay and

from sandy soils, from sod, and from cultivated land, from young, rapidly growing trees, and from older trees with more steady habits.

(4) A determination of the behavior of the fruit under the conditions outlined in temperatures of 31° to 32° F., and in 34° to 36° F.

(5) A determination of the behavior of the fruit when removed from storage, and of its value to the consumer.

The fruit used in the investigations has been taken from central and eastern Kansas, southwestern and central Missouri, southern and central Illinois, western Michigan, northeastern West Virginia, northern and western Virginia, western North Carolina, central Delaware, southern Maine, central Massachusetts, and from eastern, central, and western New York. A description of each orchard accompanies the data included in the account of the variety test. (See pages 34 and 35.)

The fruit has been stored in the following cold-storage houses: Washington Market Company, Washington, D. C.; Reading Terminal Market, Philadelphia, Pa.; Quincy Market Cold Storage Company, Boston, Mass.; Buffalo Cold Storage Company, Buffalo, N. Y.; Western Cold Storage Company, Chicago, Ill.; Twin City Ice and Cold Storage Company, Champaign, Ill., and the Armour Packing Company, Kansas City, Mo.

It has been necessary to duplicate the work in different parts of the country, as the climatic and other conditions and the varieties differ in each section. The work must be repeated for several successive seasons before general conclusions can safely be drawn from it, as the climatic conditions differ each year and thereby affect the results.

FACTORS INFLUENCING THE KEEPING QUALITY OF APPLES.

THE MATURITY OF THE FRUIT WHEN PICKED.

In recent years there has been a tendency to pick the apple crop relatively earlier in the season than formerly. It is quite generally supposed that the longest keeping apples are not fully developed in size or maturity and that the most highly colored fruit is less able to endure the abuses that arise in picking, packing, and shipping.

Aside from these general impressions, several important economic factors have influenced the picking time. A large proportion of the apple crop is purchased in the orchard by the barrel or by the entire orchard by a comparatively few apple merchants. The fruit may be picked and barreled either by the grower or by the purchaser, but with the growing scarcity of farm hands and other labor it has become necessary to begin picking relatively earlier in the autumn to secure the crop before the fall storms or winter months set in.

The general increase in freight traffic during the past few years has overtaxed the carrying capacity of the railroads as well as their terminal facilities for freight handling, and has influenced the apple dealers

to extend the picking and shipping season over the longest possible time, in order to avoid congestion and consequent delays in shipping and in unloading the fruit. The facilities at the warehouses are often inadequate for the quick handling of the fruit from the cars when it is received in unusually large quantities, and this condition has also favored a longer shipping season.

In localities where the entire crop is sometimes ruined by the bitter rot after the fruit is half grown the picking of the apples is often begun early in the season in order to secure the largest amount of perfect fruit.

It is not generally the case, however, that the immature and partly colored fruit has the best keeping quality. On the other hand, an apple that is not overgrown and which has attained full growth and high color, like the lower figure of York Imperial in Plate I, frontispiece, but is still hard and firm when picked, equals the less mature fruit (upper figure, Plate I) in keeping quality, and often surpasses it. The mature fruit is superior in flavor and texture; it is more attractive to the purchaser, and therefore of greater money value. It retains its plumpness longer and is less subject to apple scald. If, however, the fruit is not picked until overripe, it is already near the end of its life history, and will deteriorate rapidly unless stored soon after picking in a low temperature.

In the experiments with the Tompkins King and the Sutton apples grown in New York on rapidly growing young trees producing unusually large apples, the fruit that was three-fourths colored kept longer than the fully colored apples from the same trees. Dark red Tompkins King showed 28 per cent of physiological decay in February following the storage. Light, half red Tompkins King from the same trees, picked at the same time, showed 10 per cent of physiological decay in February following the storage. Plate II shows Tompkins King in February at two degrees of color. The fruit represented by the lower specimen had the longer-keeping quality, even though both lots were hard when picked. Whether the same conditions hold true of other varieties that are overgrown has not been determined.

A considerable number of later varieties may be picked when they are beginning to mellow, and will keep for months in prime condition provided they are handled with great care and quickly stored after picking in a temperature of 31° to 32° F. Fruit in this ripe state can not be left in the orchard or in warm freight cars, or in any other condition that will cause it to ripen after picking, without seriously injuring its value. In this ripe condition it should be stored in boxes, and a fruit wrapper will still further protect it.

Apples that are to be stored in a local cold-storage house to be distributed to the large markets in cooler weather may be picked much later than fruit requiring ten days or more in transit, but the use of

the refrigerator car makes late picking possible where the fruit must be in transit for a considerable time in warm weather in reaching a distant storage-house.

HOW TO OBTAIN MORE UNIFORM AND BETTER COLORED FRUIT.

While it is not the purpose of this publication to discuss cultural practices in the orchard, some suggestions in relation to the methods of securing more mature and more highly colored fruit may not be without value to the fruit grower.

A large proportion of the poorly colored fruit from old orchards is caused by dense-headed trees and close planting, which prevent the free access of air and sunlight and delay the maturity of the fruit in the fall. The fundamental corrective in such cases lies in judicious pruning, by which means the fruit may be exposed to the sunlight.

In other cases the poor color may be due to a combination of heavy soil, tillage, frequent turning in of nitrogenous cover-crops, spraying, and neglect in pruning. These conditions stimulate the trees to active growth, the foliage increases in health, size, and quantity, and, as the water-holding capacity of the soil is enlarged by the incorporation of the cover-crops and is retained by the tillage, the trees grow late in the fall and the fruit does not properly color before the picking season arrives. It is often possible to overcome the difficulty by severely pruning the top to let in more air and light. If this treatment does not prove efficient, the cover-crops may be withheld, when the fruit will usually mature earlier in the fall, unless the season is wet. As an additional treatment where necessary, the growth of the orchard may be still further checked by seeding it down until the desired condition is attained.

It is not possible to secure a uniform degree of maturity and size when all the apples on a tree are picked at one time, as fruit in different stages of growth is mixed together on the same tree. The apples differ in size and maturity in relation to their position, the upper outer branches producing the large, highly colored and early ripening fruit, while the apples on the side branches and the shaded interior branches ripen later. Greater uniformity in these respects is approached by proper pruning and by other cultural methods, but the greatest uniformity can be attained when, like the peach or the pear, the apple tree is picked over several times, taking the fruit in each picking that approaches the desired standard of size and maturity.

Summer apples, like the Yellow Transparent, Astrachan, and Williams, are usually picked in this manner, and fall varieties, like Twenty Ounce, Oldenburg, and Wealthy, are sometimes treated similarly. In recent years a few growers of winter apples have adopted the plan for the late varieties, with the result that the size, color, and ripeness of a larger proportion of the fruit are more uniform. This

method of picking is not usually adapted to the apple merchant who buys the crop of a large number of orchards, and who can not always secure efficient or abundant labor, but for the specialist who is working for the finest trade and who has a storage house near by or a convenient refrigerator car service to a distant storage house, the plan has much to commend it.

INFLUENCE OF DELAYING THE STORAGE OF THE FRUIT.

The removal of an apple from the tree hastens its ripening. As soon as the growth is stopped by picking, the fruit matures more rapidly than it does when growing on the tree and maturing at the same time. The rapidity of ripening increases as the temperature rises, and it is checked by a low temperature. It appears to vary with the degree of maturity at which the fruit is picked, the less mature apples seeming to reach the end of their life as quickly as or even sooner than the more mature fruit. It varies with the conditions of growth, the abnormally large fruit from young trees or fruit which has been overgrown from other causes ripening and deteriorating very rapidly. It differs with the nature of the variety, those sorts with a short life history, like the summer and fall varieties, or like the early winter apples, such as Rhode Island *Greening*, Yellow Bellflower, or Grimes *Golden*, progressing more rapidly than the long-keeping varieties like Roxbury, Swaar, or Baldwin.

Any condition in the management of the fruit that causes it to ripen after it is picked brings it just so much nearer the end of its life, whether it is stored in common storage or in cold storage, while treatment that checks the ripening to the greatest possible degree prolongs it.

The keeping quality of a great deal of fruit is seriously injured by delays between the orchard and the storage house. This is especially true in hot weather and in fruit that comes from sections where the autumn months are usually hot. If the apples are exposed to the sun in piles in the orchard, or are kept in closed buildings where the hot, humid air can not easily be removed from the pile, if transportation is delayed because cars for shipment can not be secured promptly, or if the fruit is detained in transit or at the terminal point in tight cars which soon become charged with hot, moist air the ripening progresses rapidly and the apples may already be near the point of deterioration or may even have commenced to deteriorate from scald, or mellowness, or decay when the storage house is reached.

On the contrary, the weather may be cool during a similar period of delay and no serious injury result to the keeping quality, or the ripening may be checked in hot weather by shipping the fruit in refrigerator cars to a distant storage house.

The fungous diseases of the fruit, such as the apple scab (*Fusicladium dendriticum* (Wallr.) Fckl.) and the pink mold (*Cephalothecium roseum* Cda.) which grows upon the scab, the blue mold (*Penicillium glaucum* Link) which causes the common, soft, brown rot, the black rot (*Sphæropsis malorum* Pk.), and the bitter rot (*Glæosporium fructigenum* Berk.) develop very fast if the fruit becomes heated after picking. The conditions already enumerated which cause the fruit to ripen quickly during the delay between the orchard and the storage house are also most favorable to the development of fruit diseases. It is therefore of the greatest importance that the fruit be stored immediately after picking, if the weather is warm, in order to insure it against the unusual development of the fungous rots.

In the fall of 1901, when the weather in western New York was cool, there was no apparent injury from delaying the storage of a large number of varieties two weeks and then shipping the fruit to Buffalo, the transit occupying from one to three days. There was also no apparent injury to the fruit from Virginia treated in a similar manner, but in southwestern Missouri, where it was warmer, the apples delayed two weeks before storing were seriously injured in their commercial keeping qualities.

The results accomplished during 1902 have been of the most instructive character. During the later half of September the temperature in eastern New York averaged about 62° F., with a humidity of 84°. During the first half of October the average temperature was 53° F. and the humidity 80°.

Rhode Island *Greening*, Tompkins King, and Sutton apples picked September 15, 1902, and stored within three days, were firm till the following March, with no rot or scald, but fruit from the same trees not stored till two weeks after picking was badly scalded or decayed by the 1st of January. None of the immediate-stored fruit was scalded or decayed by the 1st of February, but the delayed Sutton and Rhode Island *Greening* apples were soft and mealy, and one-third were scalded at that time, while nearly 40 per cent of the delayed Tompkins King were soft and worthless. The commercial value of these varieties was injured from 40 to 70 per cent by the delay in storage.

Apples of these varieties picked from the same trees on October 5, 1902, and stored immediately, and also some stored two weeks later, were less injured by the delay, as the temperature and humidity were not sufficiently high to cause rapid ripening or the development of the fruit rots.

From the standpoint of the orchardist or apple dealer who can not secure quick transportation to the large storage centers, or who can not obtain refrigerator cars, or who is geographically situated where the weather is usually warm in apple-picking time, the local storage plant in which the fruit can be stored at once and distributed in cool weather offers important advantages. The importance of this phase

of the fruit-storage business and its relation to the fruit-growing industry are emphasized as the apple business enlarges.

INFLUENCE OF STORAGE TEMPERATURE.

The investigations indicate that the ripening processes are delayed more in a temperature of 31° to 32° F. than in 35° to 36° F. The apple keeps longer in the lower temperature, it scalds less, the fruit rots and molds are retarded to a greater extent, while the quality, aroma, flavor, and other characteristics of the fruit are fully as good, and when removed from storage it remains in good condition for a longer period.

The impression is quite general that fall varieties and the tender early winter sorts, like Fameuse, Wealthy, and Grimes, are injured in some way by the low temperature, but the investigations of the Department of Agriculture indicate that these varieties behave more satisfactorily in every respect when stored at 31° to 32° F.

If the fruit is intended for storage for a short time only, and it is desired to have it ripen before removing it from the storage house, then a higher temperature may be desirable to hasten the maturity.

The influence of the temperature on the ripening processes appears to depend on the condition of the fruit. Baldwin, Esopus *Spitzenburg*, Roxbury, Jonathan, Lady Sweet, and other long-keeping eastern-grown varieties have been held in prime commercial condition throughout the storage season in a temperature of 35° F. when carefully picked and handled and stored soon after picking; but when the fruit was carelessly handled or the storage was delayed in hot weather, then a temperature of 31° to 32° F. was required to retard the ripening.

It might be safe to use a temperature of 34° to 35° F. in a storage house located near the orchard, in which the fruit may be stored immediately after harvesting, but for general commercial apple handling, a temperature as low as 32° F. is needed to overcome the abuses that usually arise in picking, packing, and shipping.

No definite investigations have been made by the Department of Agriculture as to the effect of temperatures lower than 31° F. The exact freezing point of apples has not been determined, but it is below this point. It may possibly vary with the composition or condition of the variety. Under the most favorable conditions, apples are sometimes commercially stored at 30° F. without injury, but 31° F. should be considered a critical temperature below which it is unsafe to store this fruit, except in houses that are properly constructed and in which the temperature is maintained uniform in all parts of the rooms.

Apples are sometimes frozen in the storage rooms owing to a considerable drop in the temperature or to a poor distribution of the cold air. If the fruit compartment adjoins a freezer room and the insulation is poor, the fruit may be frozen in packages piled close to the freezer

wall. Apples placed near the refrigerating pipes or near the cold-air duct where it enters the room may be injured by freezing if the plant is improperly installed or managed; or if the piping or air circulation is faulty, the temperature at the bottom may be lower than that at the top of the room.

The frosting of the fruit does not necessarily injure it. When the apple freezes, the water in the cells is withdrawn and frozen in the intercellular spaces, and if it thaws slowly and the freezing has not been too severe, the cells may regain the water without injury and resume their living function. If the thawing is rapid, the cells may not reabsorb the water with sufficient rapidity, and in this case it remains in the intercellular spaces and is lost by evaporation. In addition, the tissues next to the area of greatest freezing may be forced apart by the formation of ice crystals in the intercellular spaces.

If the freezing is so severe as to withdraw too much of the cell water, the cells may not be able to absorb it and will be killed in the same manner as if dried out in any other way. Occasionally the freezing is so rapid that besides the withdrawal of water the cell contents are disorganized or possibly frozen outright; at any rate, the cell may be directly killed by a sudden change of temperature. It is probable that varieties may differ as to the degree of freezing they will stand without injury, and further, that the same sort may vary in this respect when grown under different conditions or subjected to different treatment.

The most characteristic results of injurious freezing are a translucent appearance of the skin of the fruit, a water-logged and springy or spongy condition of the flesh, a forcing apart of the tissues, and a brownish discoloration of the flesh. The browning may result from any cause which results in the death of the cells and is not necessarily characteristic of freezing. It often happens that the skin of the fruit retains its normal brightness after the interior has discolored.

In the practical handling of frozen stock, the temperature should be raised very slowly until the frost is withdrawn. If possible, the fruit should not be moved until it is defrosted, as it discolors quickly wherever a slight bruise occurs or even where the skin is lightly rubbed. With these precautions observed it is often possible to defrost stock that is quite firmly frozen without apparent injury to it.

INFLUENCE OF A FRUIT WRAPPER.

In the storage investigations under discussion a comparison has been made between wrapped and unwrapped stock on the keeping quality of the fruit, and the efficiency of different kinds of paper for wrappers—tissue, parchment, waxed or paraffin, and unprinted news—has been tested. A box of unwrapped fruit, with packages of fruit wrapped with the kinds of paper mentioned in order above, is shown in Plate III, fig. 1.

It has been found that the wrapper may influence the keeping quality in several different ways. It extends the life of the fruit beyond its normal period by retarding the ripening processes. The influence of the wrapper in this regard is apparent especially at the end of the normal storage season of the naked fruit when the flesh begins to grow mealy from overripeness. At this time the wrapped apples may be firm and remain in prime condition for several weeks or even months. The wrapper is especially useful in extending the season of early winter sorts, or in making the long-keeping varieties available for use over a still longer period of time.

The wrapper may be useful in preventing the transfer of rot from one apple to another. If the fungus is capable of growing in the storage temperature, it is not likely that the wrapper retards its growth, but when the spores develop they are confined within the wrapper and their dissemination is difficult or impossible.

The importance of a wrapper in protecting the fruit from decay and in extending its season may be better appreciated by reference to the following:

Amount of decayed fruit April 29, 1903, in bushel packages.

Variety.	News paper wrapped.	Unwrapped.	Variety.	News paper wrapped.	Unwrapped.
	Per cent.	*Per cent.*		*Per cent.*	*Per cent.*
Baker	3.7	27.2	Northern Spy	5.6	52.0
Dickenson	6.4	43.0	Wagener	38.0	63.0
McIntosh	7.7	15.0	Wealthy	42.0	60.0
McIntosh (second lot)	19.7	32.0			

The wrapper protects the apple against bruising and the discoloration that may result from improper packing or rough handling; it checks transpiration, and by the preservation of the attractive appearance and firmness of the fruit adds to its commercial value.

No important difference was noticeable in the efficiency of the different wrappers, except that a mold developed freely on the parchment paper in a temperature of 36° F. This mold grew only to a slight extent in 32° F.

A double wrapper is more efficient in retarding ripening and transpiration than a single wrapper. A good combination consists in a porous news paper next to the fruit, with an impervious wax or paraffin wrapper on the outside. The wrappers vary in cost from 20 cents per thousand for news paper, 9 x 12 inches, to 70 cents per thousand for the better grades of paraffin.

INFLUENCE OF CULTURAL CONDITIONS.

Preliminary studies have been made on the influence of cultural and other conditions surrounding the growing fruit on its storage quality.

Considerable data along this line will be brought out in the comparison of the same variety grown in different sections. It has been observed that the Tompkins King, Hubbardston, and Sutton apples from rank-growing young trees ripen faster than smaller fruit from older slower-growing trees, and therefore reach the end of their life history sooner. From older trees these varieties have kept well till the middle of April, while from young trees the commercial storage limit is sometimes three months shorter.

It has been noticed that Rhode Island *Greening* apples from old trees remain hard longer than the same variety from young trees, but the greener condition of the fruit from the older trees when picked at the same time made it more susceptible to scald. Rhode Island *Greenings* from Mr. Grant G. Hitchings, South Onondaga, N. Y., showed 50 per cent of scald from young trees on April 28, 1903, and 82 per cent in smaller, greener fruit from older trees.

Rhode Island *Greening*, Mann, and Baldwin apples grown on sandy land ripened more rapidly than similar fruit from clay land, where all of the other conditions of growth were similar. Plate IV shows the average condition of Baldwin apples on April 28, 1903, grown on sandy and clay soil in the orchard of Mr. W. T. Mann, Barker, Niagara County, N. Y., and stored in a temperature of 32° F. The upper apple was grown on clay; the lower, on sandy soil.

The subject will require critical study over a period of years before it will be possible to fully understand the influence of various cultural, climatic, and other conditions of growth on the life processes in the fruit.

INFLUENCE OF THE TYPE OF PACKAGE.

The principal storage packages for apples are barrels of about 3 bushels capacity and boxes holding 40 to 50 pounds. The larger the bulk of fruit and the more it is protected from the air the longer it retains the heat after entering the storage room. If the fruit is hot and the variety a quick-ripening sort, it may continue to ripen considerably in the center of the package before the fruit cools in that position. The long-keeping varieties that are harvested and shipped in cooler weather are less likely to show the effect of the type of the package. The smaller package therefore presents distinct advantages for the early, quick-ripening varieties and is most useful in the hottest weather, as the fruit cools down quickly throughout the package and its ripening proceeds uniformly.

There is a wide difference of opinion concerning the comparative value of ventilated and closed packages for apple storage. The chief advantage of the ventilated package appears to lie in the greater rapidity with which its contents cool off, and its value in this respect depends on the amount of ventilation in the package. The contents

of an ordinary ventilated apple barrel do not cool much more quickly than the contents of a closed barrel, and the value of the ventilated barrel for the purpose for which it is designed is somewhat doubtful.

Apples in a ventilated package are likely to shrivel if the fruit is stored for any length of time. In the ordinary ventilated apple barrel the exposure is not sufficient to affect the fruit to any extent, but in boxes in which there is much exposure the fruit may be corky or spongy in texture if held until spring.

The size of the package may have an important influence on the length of the storage season. Its influence in this respect is especially marked when the fruit begins to mellow in texture. Barrel stock in this condition needs to be sold to prevent the bruising of the fruit from its own weight, but apples equally ripe may be carried in boxes safely sometimes for several weeks longer.

THE BEHAVIOR OF THF FRUIT WHEN REMOVED FROM STORAGE.

There is a general impression that cold-storage apples deteriorate quickly after removal from the warehouse. This opinion is founded on the experience of the fruit handler and the consumer, but the impression is not generally applicable to all storage apples. In fact, it is probable that storage apples do not deteriorate more quickly than other apples that are equally ripe and are held in the same outside temperature. If the fruit is overripe when taken from storage—and a good deal of stock is stored until it reaches this condition—it naturally breaks down quickly; but firm stock may be held for weeks and even months after it has been in storage.

The rapidity of deterioration depends also on the temperature in which the fruit is removed. The following table shows the amount of decay in Baldwin apples from the same barrel after removal and subjection to different temperatures:

Amount of decay after removal from storage to different temperatures.

Variety.	Date removed from storage (1903).	Date inspected.	Per cent rot.			
			44° F.	48° F.	61° F.	67° F.
Baldwin	Jan. 29	Jan. 29	0	0	0	0
		Feb. 10	0	0	3	10
		Feb. 13	0	0	12	14
		Feb. 16	0	0	21	24
		Feb. 20	0	4	23	28
		Mar. 3	5	10	.....	.....
		Mar. 7	5	15	.....	.....
		Mar. 24	20	.....	.....	.....
		Apr. 6	36	.....	.....	.....

Late in the spring the fruit is far advanced in its life and the weather is becoming warmer. All apples similarly ripe, whether in cold storage or not, break down more quickly at this time than in the winter.

In commercial practice the dealer often holds the apples for a rise in price, and finally removes them from the warehouse, not because the market has improved, but for the reason that he finds that a longer storage would result in serious deterioration from fruit rots and over-ripeness. When a considerable amount of stock is decayed on removal from the warehouse the evidence is conclusive that the apples should have been sold earlier in the season. In the purchase of cold-storage stock the consumer will have little cause to complain of the rapid deterioration of the fruit if he exercises good judgment in the selection of apples that are still sound and firm.

THE IMPORTANCE OF GOOD FRUIT.

Apples do not improve in grade in cold storage. In handling a crop too much care can not be given to grading the fruit properly before it enters the storage house. The contents of many packages are injured by the spread of disease from a few imperfect apples. Rots enter the fruit most easily wherever the skin is bruised or broken, and in the early stages of the rot development it is common to see the diseases manifesting themselves around worm holes or bruises occasioned by rough handling, from nails that protrude through the barrels, or from other causes.

When the crop is light it may pay to store apples that are not of the first grade, but such fruit should be rigidly eliminated from the best stock and stored where it can be removed earlier in the season than the better qualities.

The attractiveness and the value of the best fruit is often injured by careless handling. A bruised spot dies and discolors. Finger marks made by pickers, graders, and packers, and injuries from the shifting of the fruit in transit or from rough handling, become more apparent as the season advances. In fact, all of the investigations of the Department of Agriculture emphasize the fundamental importance of well-grown, carefully handled fruit in successful storage operations.

Plate III, fig. 2, shows a barrel of Northern Spy apples poorly packed. On the right is shown a barrel of Esopus well packed. A great deal of fruit is taken from storage "slack," the fruit not being firmly packed in the barrels in the orchard.

APPLE SCALD.

When some varieties of apples reach a certain degree of ripeness the part of the fruit grown in the shade often turns brown, not unlike the color of a baked apple. This difficulty does not extend deep into

the flesh, but it detracts from the appearance of the fruit and reduces its commercial value. This trouble is commonly called "apple scald." It may appear in fruit held in common or in cold storage.

The exact nature of scald is not well understood, though apple men have many theories by which its appearance is popularly explained. The most common theory gives rise to the name of scald—that is, the brown, cooked appearance is thought to be due to the overheating of the fruit when it is stored, or to a temperature too low for the variety, or to picking the fruit when too ripe; and other matters relating to the growth and handling of the fruit are thought to develop it.

As the scald is an important commercial problem it has been considered from several standpoints in the fruit-storage investigations of the Department. The nature of the scald, the influence of the degree of maturity of the fruit when picked, of commercial methods of handling, of fruit wrappers, of different temperatures, and of cultural conditions on its development are among the problems investigated.

NATURE OF THE SCALD.

Apple scald is not a contagious disease. According to Dr. A. F. Woods, Pathologist and Physiologist of the Department of Agriculture, it is a physiological disturbance not connected in any way with the action of parasitic or saprophytic organisms such as molds or bacteria. Briefly, it is the mixing of the cell contents or premature death of the cells and their browning by oxidation through the influence of the normal oxidizing ferments of the cell. There are many conditions which influence the development of this trouble. It appears to be closely connected with the changes that occur in ripening after the fruit is picked, and is most injurious in its effects as the fruit approaches the end of its life. Several of the factors that influence it will be discussed. Plate V shows the scald on a Rhode Island *Greening* apple. The cross section shows that scald does not extend deep into the flesh.

INFLUENCE OF MATURITY OF THE FRUIT ON SCALD.

The scald always appears first on the green or less mature side of an apple, and if the fruit is only partly ripe it may spread entirely over it; but the portions grown in the shade and undercolored are first and most seriously affected. The upper figure in Plate I (frontispiece) shows the distribution of scald on an immature York Imperial apple. The apples that are more mature and more highly colored when picked are less susceptible to injury, and the side grown in the sunlight may remain entirely free from it. The lower figure in Plate I shows a well-colored York Imperial apple and its freedom from the scald is noticeable.

When the apple crop is picked before it is mature the fruit is more susceptible to scald than it would have been later in the season. The

relative susceptibility of immature and more mature apples is brought out in the table following. The fruit was picked two weeks apart. At the first picking the apples were partly colored, or in the condition in which a large proportion of the commercial apple crop is harvested. At the second picking the fruit was more mature, with better color, but still hard. The differences in ripeness are fairly represented in the fruit on Plates I and II. The percentages do not represent the relative susceptibility of the different varieties to scald, as the fruit was grown in different States and the observations were made at different times. The percentages show the average amounts of scald in fruit stored at temperatures of 31° to 32° F. and 34° to 36° F.

Scald on mature and immature apples.

Variety.	Locality grown.	Mature, well colored.	Immature, partly colored.
		Per cent.	*Per cent.*
Baldwin	New York	3.1	29.2
Ben Davis	Illinois	2.6	15.8
Do	Virginia	13.1	41.6
Rhode Island *Greening*	New York	25.4	43.4
Winesap	Illinois	0.2	31.8
Yellow Newtown	Virginia	2.3	9.4
York Imperial	do	2.0	18.2
Average		6.9	27.0

In the practical handling of orchards the fundamental corrective of scald lies in practicing those cultural and harvesting methods that develop maturity and a highly colored fruit. These methods have already been briefly discussed. The picking of the fruit when too green, dense-headed trees that shut out the sunlight, heavy soil, a location or season that causes the fruit to mature later than usual and makes it still green at picking time—these are among the conditions that make it particularly susceptible to the development of the scald.

After the fruit is harvested its susceptibility increases as its ripening progresses. Early in the storage season the scald may not appear, but later the same variety may have developed enough to injure its commercial value. The amount of scald at different periods of the season on the same lot of Baldwin apples stored at 32° F. is brought out in the following statement:

Amount of scald at different periods of storage season.

	Per cent.
January 29, 1903	0
February 21, 1903	0
March 20, 1903	20
April 21, 1903	23

It should be the aim of the apple storer to remove the fruit from storage before a variety normally begins to scald and to hold until late in the season only those sorts that do not scald.

INFLUENCE OF TEMPERATURE ON SCALD.

The temperature that checks the ripening to the greatest degree also retards the appearance of the scald. In some of the apple-growing sections it is quite generally believed that bad scalding varieties should be stored in a temperature of 36° to 38° F., and that a temperature as low as 32° F. hastens its development. The investigations of the Department have shown that this impression is not well founded, but on the contrary they indicate that the scald develops more freely in the higher temperature. To illustrate, one lot of York Imperial apples, a variety which is greatly affected by scald, had developed 16.9 per cent of this trouble by January 22, 1902, in a temperature of 36° F., while a similar lot stored in a temperature of 32° F. developed only 3.4 per cent. One lot of Rhode Island *Greening* apples by February 3, 1903, had developed 21 per cent in 32° F., while a similar lot, in 36° F., showed 55 per cent. In the case of the Sutton apple, investigation showed 25 per cent of scald in apples stored at 32°, and 42 per cent where the temperature was kept at 36°.

If the fruit is stored as soon as it is picked, or is shipped in refrigerator cars or in cool weather, and if it has been handled in the most careful manner, the ripening may not proceed much more rapidly and the scald may not develop more freely in the higher than in the lower storage temperature.

THE TEMPERATURE IN WHICH THE FRUIT IS REMOVED FROM THE STORAGE-HOUSE.

When the fruit is removed from the storage-house the scald sometimes develops rapidly. Its appearance at this time seems to depend on at least two important conditions—the ripeness of the fruit and the temperature into which it is taken. Late in the storage season the scald is most severe; first, because the fruit is more mature, and, second, for the reason that the warm weather prevailing at that season develops it quickly.

The development of the scald also seems to be influenced by the amount of humidity in the air. So long as the fruit remains cold and condenses the moisture of the atmosphere upon it the scald is retarded more than in a dry air of the same temperature.

The accompanying table shows the rapidity with which the scald may develop on Baldwin apples when portions of the same barrel are removed to different temperatures. There was no increase in the amount of scald in any of the lots after nine days.

Scald developed in different temperatures when apples were removed from storage.

Variety.	Date removed from storage.	Date inspected.	Per cent of scald.			
			44° F.	48° F.	61° F.	67° F.
	1903.	1903.				
Baldwin	Jan. 29	Jan. 29	0	0	0	0
Do	....do ...	Feb. 3	0	6	21	22
Do	....do ...	Feb. 4	4	11	21	37
Do	....do ...	Feb. 6	4	25	40	63
Do	....do ...	Feb. 7	4	25	41	63

The upper figure in Plate VI shows the average condition of a lot of Wagener apples in March, 1903, when removed from storage; the lower figure, the average condition of the same fruit forty-eight hours later in a temperature of 70° F.

It should be the aim of the fruit s orer not only to remove the fruit before the scald normally appears, but to hold the apples after removal in the lowest possible temperature to prevent its rapid development.

INFLUENCE ON SCALD OF DELAYING THE STORAGE OF THE FRUIT AFTER IT IS PICKED.

The ripening of the fruit between the time of picking and its storage increases its susceptibility to scald.

When the picking and shipping seasons are cool and dry it may be possible to delay the storage of the fruit for some time without injury so far as the predisposition to scald is concerned. In the investigations of 1901–2 in western New York there was no apparent injury from delaying the storage, but the weather conditions at this period were ideal for apple handling.

The scald develops seriously when the storage of the fruit is delayed in hot weather. Detentions in the orchard, in transit in closed cars, in unloading at the terminal, or in the warehouse cause the fruit to ripen quickly and favor the rapid growth of the fruit rots, as they bring the fruit much nearer the end of its life before it enters the storage room. Under these circumstances the fruit may scald badly, mellow early in the season, and rot, and no storage treatment can correct the abuses to which it has been subjected.

The following table brings out the injury that may be caused by delaying the storage of the fruit in hot weather. The mean average temperature between September 15 and 30, 1902, was about 62° F. and the mean average humidity about 84°. Fruit picked from the same trees on October 4, 1902, and stored two weeks later, when the temperature was about 53° F. and the humidity about 80°, was not injured by the delay. The apples referred to were grown in eastern New York and stored in Boston, and these records were taken the following February.

Scald on immediate- and delayed-stored apples in February, 1903.

Variety.	Picked Sept. 12, 1902; stored Sept. 15.	Picked Sept. 15; stored Sept. 30.	Picked Oct. 4; stored Oct. 9.	Picked Oct. 5; stored Oct. 19.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Rhode Island *Greening*	0	38	(No record)	(No record)
Sutton	0	33	0	0
Tompkins King	0	15	0	0

INFLUENCE OF A FRUIT WRAPPER ON SCALD.

The influence of the various fruit wrappers mentioned has been studied in connection with the scald. Sometimes the wrappers retard it to a slight degree, but often the trouble is as severe or more severe in the wrapped fruit. Whenever the wrapper has been effective in retarding the scald the wax or paraffin paper was most useful.

The following table gives a comparison between wrapped and unwrapped fruit, and emphasizes the fact that for commercial purposes the wrapper should not be looked upon as an effective means of preventing the trouble. The records of each variety are based on 8 to 32 bushels of fruit, one-half of which was wrapped.

Scald on wrapped and unwrapped fruit.

Variety.	Locality.	Wrapped.	Unwrapped.
		Per cent.	*Per cent.*
Baldwin	New York	12.4	19.9
Ben Davis	Illinois	5.8	2.8
Do	Virginia	27.1	28.7
Huntsman	Illinois	47.8	40.3
Minkler	do	22.9	20.1
Rhode Island *Greening*	New York	32.3	37.6
Winesap	Virginia	30.0	47.0
Do	Illinois	17.9	10.2
York Imperial	Virginia	9.6	12.9

VARIETIES MOST SUSCEPTIBLE TO SCALD.

All varieties are not equally susceptible to scald, and there appears to be a wide difference in the amount developed in the same variety grown in different parts of the country. While the light-colored portion of an apple is more susceptible than the more highly-colored part, it does not follow that green or yellow varieties are more susceptible than red ones. Of the important commercial sorts used in the investigations of the Department of Agriculture, the varieties named in the subjoined list have proved most susceptible. The season when the scald is most likely to appear is given with each kind, though there may be a wide variation from year to year. The time of the

appearance of the scald is influenced to an important degree by the method of handling the fruit and by its degree of ripeness. A larger number of varieties showing scald to a slight extent will be found mentioned in the notes in the variety catalogue.

Arctic, serious, midwinter.
Arkansas, often serious, after midwinter.
Baldwin, often serious, late in season.
Ben Davis, often serious, late in season.
Gilpin, often serious, late in season.
Green Newtown, slight, late in season.
Grimes, serious, early winter.
Huntsman, serious, midwinter.
Lankford, serious, midwinter.
Nero, serious, midwinter.
Paragon, sometimes serious, midwinter.
Ralls, slight, midwinter.
Rhode Island *Greening*, serious, midwinter.
Smith *Cider*, serious, early winter.
Stayman Winesap, sometimes serious, midwinter.
Wagener, serious, midwinter.
White Doctor, serious, midwinter.
White Pippin, slight, late in season.
Willow, slight, late in season.
Winesap, often serious, late in season.
Yellow Newtown, slight, late in season.
York Imperial, serious, midwinter.
York Stripe, slight, late in season.

TREATMENT TO PREVENT SCALD.

Through the cooperation of the Bureau of Chemistry and the Office of Vegetable, Pathological, and Physiological Investigations, of the Department of Agriculture, preliminary studies have been undertaken to determine the influence of various gases and other forms of treatment on the development of the scald on Ben Davis apples picked in Illinois in August, 1902. The fruit was kept in cold storage till used in the experiments in 1903, when some was slightly scalded. Different lots were placed under the following conditions. The result of the treatment on the scald and fruit is briefly stated in each case.

(1) In air containing formaldehyde vapor. No effect.

(2) In air containing a large amount of sulphur dioxid. Fruit injured.

(3) In air containing one one-hundredths volume sulphur dioxid. No effect on scald, but fruit injured in spots.

(4) In air containing chlorin. Fruit injured around lenticels and scald not prevented.

(5) In air containing alcohol vapor. Fruit uninjured; scald not prevented.

(6) In air containing ether vapor. Fruit uninjured; scald not prevented.

(7) In air containing chloroform vapor. Fruit killed.

(8) In air containing turpentine vapor. Fruit injured; scald not prevented.

(9) In atmosphere of moist oxygen. Fruit uninjured; scald developed more rapidly than in pure air.

(10) In atmosphere of moist nitrogen. Scald entirely prevented, and fruit apparently normal at end of nine days.

(11) Fruit placed in water. Scald retarded; fruit uninjured.

(12) Paraffin over fruit. Scald slightly retarded; fruit uninjured.

(13) Vaseline over fruit. Scald somewhat retarded; fruit uninjured.

(14) Olive oil over fruit. Scald somewhat retarded; fruit uninjured.

It will be seen from the brief outline that the fruit may be injured by some of the gases and that nitrogen was the only gas that prevented scald without injuring the fruit. It is reasonable to assume that a continuation of the fruit in nitrogen gas for a much greater length of time would be injurious, as oxygen is essential to the vital processes. It will be noticed, also, that oxygen stimulated the development of the scald probably by making the conditions favorable for the rapid progress of the scald-producing ferment.

COMPARISON OF VARIETIES IN COLD STORAGE.

A large number of varieties of apples grown under various conditions have been under observation by the Department of Agriculture. It has been the purpose of the investigation to determine the keeping quality of the varieties during the commercial apple-storage season, which usually terminates May 1 or shortly afterwards. It has not been attempted to carry the varieties longer than the apple-storage season, though many of them when finally taken from the storage house have been in prime condition and would have kept well for a longer period.

There is a wide difference in the keeping quality of the same variety when it is grown in different parts of the country. There is a striking variation also in the behavior of the same variety when it is grown in the same locality under different cultural conditions and in different seasons. There may be a permanent difference in the keeping quality of the apples of one region when compared with those of another, but it is not safe to draw general conclusions in this regard until the varieties of each have been under observation during several seasons and have been grown under different cultural conditions. No attempt has been made in these investigations to draw comparisons between the keeping quality of the same sort from different places. The behavior of each lot is given in commercial terms rather than in detailed notes, so that the grower or apple handler may know something of the storage value of a variety under the conditions in which it has been observed by the Department of Agriculture. The fruit has been stored in bushel boxes in a temperature of 30° to 32° F.

The Department had the cooperation of the Kansas, Maine, New York State, and Virginia agricultural experiment stations in 1901 and of the Massachusetts Agricultural College and the New York

State experiment stations in 1902 to the extent of receiving gratuitously fruit of the varieties credited to them in the variety catalogue. It had the cooperation during the season of 1901–2 of the experiment station of the University of Illinois in inspecting and making record of the condition of the fruit stored at Champaign, Ill., especially at times when it could not be conveniently inspected by the representatives of the Department.

OUTLINE OF CULTURAL CONDITIONS.

A statement follows, summarizing the orchard conditions in which the fruit used in the experiments of the Department of Agriculture was grown. In the variety catalogue each sort is credited to the grower from whom it was received:

Boggs, A. H., Waynesville, Haywood County, N. C., 1902:
Clay loam, stony, with clay subsoil; altitude, 3,000 to 3,500 feet; trees, 12 to 15 years old; thoroughly sprayed; sod culture.

Bradley, F. L., Barker, Niagara County, N. Y., 1902:
Sandy loam, with clay subsoil; altitude, about 300 feet; sprayed; tillage; on Lake Ontario.

Brown, J. E., Wilson, Niagara County, N. Y., 1901:
Sandy loam, with sandy loam subsoil; altitude, about 300 feet; trees, 40 years old; sprayed; tillage; on Lake Ontario.

Derby, S. H., Woodside, Kent County, Del., 1902:
Sandy, with clay-loam subsoil; altitude, about 60 feet; trees, 10 to 25 years; thorough spraying and tillage; annual use of clover cover crops; trees unusually vigorous.

Dodd, G. J., Greenwood, Jackson County, Mo., 1902:
Black prairie soil, with clay subsoil; altitude, 1,000 feet; trees, 18 years old, except Ben Davis, 11 years; sprayed; sod culture after trees were 7 years old.

Dunlap, H. M., Southern Illinois, 1901:
Fruit from orchards in southern Illinois; data not available.

Flournoy, W. T., Marionville, Lawrence County, Mo., 1902:
Heavy clay, with rocky limestone clay subsoil; altitude, about 1,250 feet; age of trees, 7 years; spraying and tillage.

Gilbert, Z. A., Farmington, Franklin County, Me., 1902:
Granite drift, with so-called pin-gravel subsoil; altitude, about 365 feet; age of trees, 20 years; no spraying or tillage; land top dressed with wood ashes.

Hitchings, Grant G., South Onondaga, Onondaga County, N. Y., 1901 and 1902:
Clay loam, stony, with heavy red clay or gravel-and-clay subsoil; altitude, about 1,200 feet; age of trees, 4 to 100 years; sprayed; sod culture, with grass left in orchard for mulch.

Hutchins, Edward, Fennville, Allegan County, Mich., 1902:
Clay loam; altitude, 700 feet; age of trees, about 35 years; sprayed; tillage.

Kansas Agricultural Experiment Station, Manhattan, Riley County, Kans., 1901:
Clay loam, with clay subsoil; altitude, about 1,000 feet; age of trees, 10 years; spraying and tillage.
Orchards near the experiment station, 1901: Soil and altitude same as above; no spraying or tillage; fruit received through Kansas Station.

Lupton, S. L., Winchester, Frederick County, Va., 1901 and 1902:
Clay loam, with red clay subsoil; altitude, 750 feet; age of trees, 8 years; sprayed; sod culture, grass cropped.

Maine Agricultural Experiment Station, Orono, Penobscot County, Me., 1901:
Sandy loam, with clay subsoil; altitude, about 150 feet; age of trees, 10 to 12 years; sprayed; clean culture, with fall cover crop of rye.

Mann, W. T., Barker, Niagara County, N. Y., 1902:
Clay loam, with clay subsoil, and sandy loam with sandy subsoil; altitude, about 300 feet; age of trees, about 30 years; sprayed thoroughly; tillage; clover cover crops.

Massachusetts Agricultural College Experiment Station, Amherst, Hampshire County, Mass., 1902:
Gravelly soil, with clay subsoil, moist; altitude, 250 feet; age of trees, 30 years; sprayed; tillage.

Michigan Agricultural College Experiment Substation, South Haven, Van Buren County, Mich., 1902:
Rich, sandy loam, with clay subsoil; age of trees, 9 to 14 years; altitude, 625 feet; on Lake Michigan; spraying and cultivation thorough.

Miller, W. S., Gerrardstown, Berkeley County, W. Va., 1901:
Soapstone, derived from Romney shale, clay subsoil; altitude, 700 feet; age of trees, 12 to 26 years; sprayed and cultivated.

New York State Experiment Station, Geneva, Ontario County, N. Y., 1901 and 1902:
Rather heavy clay loam, with heavy clay subsoil; altitude, about 600 feet; age of trees, generally from 15 to 25 years; sprayed, and cultivated with cover crops.

Ozark Orchard Company, Goodman, McDonald County, Mo., 1901 and 1902:
Flinty clay, with clay, shale, or gravel subsoil; altitude, 1,250 feet; age of trees, 6 years; sprayed and cultivated.

Powell, George T., Ghent, Columbia County, N. Y., 1902:
Gravelly loam, with clay-gravelly subsoil; altitude, about 400 feet; age of trees, 35 to 45 years, except Tompkins King and Lady Sweet 11 years, Sutton 8 years, Hubbardston 5 years; spraying and cultivation thorough, with clover cover crops annually.

Reeks, M., Douglas, Allegan County, Mich., 1902:
Clay loam, with clay subsoil several feet below surface; age of trees, 12 to 15 years; sprayed and cultivated; altitude, 650 to 675 feet.

Spohr, G. E., Manhattan, Riley County, Kans., 1901:
Sandy loam, with sandy subsoil; altitude, about 950 feet; age of trees, about 20 years, except Jonathan 10 years; no tillage or spraying; fruit received through Kansas Experiment Station.

Speakman, F. H., Neosho, Newton County, Mo., 1901:
Clay loam, gravelly and stony, with red clay subsoil, mixed with flint stone; altitude, 1,100 feet; age of trees, 12 years; sprayed and cultivated.

Taylor, J. F., Douglas, Allegan County, Mich., 1902:
Sandy loam, with clay subsoil 15 feet below surface; altitude, 650 to 675 feet; from 8-year top grafts on stocks of "Cannon Redstreak," 25 years old; sprayed and cultivated.

Virginia Agricultural Experiment Station, Blacksburg, Montgomery County, Va., 1901:
Rather heavy, mostly of limestone origin, with some sand, not stiff, subsoil of same nature but heavier; altitude, 2,170 feet; age of trees, 12 years; sprayed but not cultivated in 1901.

Wellhouse, F., Tonganoxie, Leavenworth County, Kans., 1901:
Rich prairie loam, with red clay subsoil, with some sand; altitude, about 900 feet; age of trees, 7 years; not sprayed but cultivated.

VARIETY CATALOGUE.

[In this catalogue the leading names of the varieties used in the cold storage investigations of the Department of Agriculture are printed in black type, with their leading synonyms in italics.]

Aiken Red. (See Akin.)

Akin. Synonym: *Aiken Red.*

W. S. Miller, Gerrardstown, Berkeley County, W. Va.: Highly colored, No. 1; picked October 12, 1901, stored October 18; sound and in good commercial condition until March 11, 1902, after which it decayed.

Albemarle. (See Yellow Newtown.)

Alexander.

M. Reeks, Douglas, Allegan County, Mich.: Large, well colored, No. 1; picked August 25, 1902, stored August 27; at commercial limit November 14, 1902.

Amos. Synonym: *Amos Jackson.*

New York State Experiment Station, Geneva, Ontario County, N. Y.: Small, hard, and green; picked September 19, 1902, stored September 27; May 1, 1903, firm, no scald or rot.

Amos Jackson. (See Amos.)

Apple of Commerce. (See Beach.)

Arctic.

Maine Agricultural Experiment Station, Orono, Penobscot County, Me.: Well colored, No. 1; picked October 7, 1902, stored October 24; January 23, 1903, in good commercial condition, scald beginning to appear; March 11, softening, color faded, all scalded.

Arkansas. Synonyms: *Blacktwig, Mammoth Blacktwig.*

W. S. Miller, Gerrardstown, Berkeley County, W. Va.: Hard, No. 1; picked October 12, 1901, stored October 18; May 1, 1902, bright, firm, and sound, no rot or scald.

Ozark Orchard Company, Goodman, McDonald County, Mo.: No. 2 stock; badly affected with "flyspeck" fungus; picked October 11, 1902, stored October 28; March 10, 1903, shriveled, considerable rot, no scald.

Virginia Agricultural Experiment Station, Blacksburg, Montgomery County, Va.: Small, sound; picked September 26, 1901, stored October 6; May 1, 1902, firm, no decay, nearly all slightly scalded on light side.

Arkansas Beauty.

W. S. Miller, Gerrardstown, Berkeley County, W. Va.: Medium size, dull greenish red; picked October 7, 1901, stored October 18; January 23, 1902, 10 per cent of decay, no scald.

Arkansas Black.

Near Kansas Experiment Station, Manhattan, Riley County, Kans.: Small, very hard, poorly colored, immature stock; picked October 5, 1901, stored October 9; March 21, 1902, very hard, with no deterioration; would probably have kept well through storage season.

W. S. Miller Gerrardstown, Berkeley County, W. Va.; Dark red, very fine, large; picked November 5, 1901, stored November 12; June 1, 1902, in prime commercial condition, hard, no scald or decay, except from injury.

Aucuba. Synonym: *Aucuba-Leaved Reinette.*

New York State Experiment Station, Geneva, Ontario County, N. Y.: Bright, well colored, No. 1; picked October 12, 1901, stored October 21; sound and in good condition until February 1, 1902.

Aucuba-Leaved Reinette. (See Aucuba.)

Bailey Sweet.

G. T. Powell, Ghent, Columbia County, N. Y.: Bright, No. 1; picked October 16, 1902, stored October 20; in prime condition until March 1, 1903, when the fruit began to mellow; no scald or decay. Identity uncertain.

Baker.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Hard, greenish, No. 1; picked September 22, 1902, stored September 29; firm and sound until March 14, 1903, after which it softened.

Baldwin.

F. L. Bradley, Barker, Niagara County, N. Y.: Mixed grade, dull, scabby; picked October 9, 1902, stored October 15; May 1, 1903, firm, no scald or rot.

J. E. Brown, Wilson, Niagara County, N. Y.: No. 1, fair color; picked October 8, 1901, stored October 15; May 1, 1902, firm, no rot, slight scald.

H. M. Dunlap, Southern Illinois: Firm, somewhat wormy; picked October 8, 1901, stored October 10; March 18, 1902, commencing to scald and decay.

Z. A. Gilbert, Farmington, Franklin County, Me.: Medium sized, dull colored; date of picking undetermined, stored November 10, 1902; May 1, 1903, firm, no decay or scald.

G. G. Hitchings, South Onondaga, Onondaga County, N. Y.: Large, dark red, No. 1; trees 12 years old; picked October 1, 1902, stored October 4; May 1, 1903, firm, no scald or rot.

W. T. Mann, Barker, Niagara County, N. Y.: Hard, finely colored, No. 1; picked October 16, 1902, stored October 18; May 1, 1903, hard, no scald or rot.

Massachusetts Agricultural College Experiment Station, Amherst, Hampshire County, Mass.: Dull greenish red, No. 1; picked October 11, 1902, stored October 15; May 1, 1903, no scald or rot, hard.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Hard, light colored, small; picked October 12, 1902, stored October 15; May 1, 1903, hard and sound; similar in 1901.

G. T. Powell, Ghent, Columbia County, N. Y.: Bright, well colored, No. 1; picked October 16, 1902, stored October 19; May 1, 1903, firm condition, no scald or decay.

Virginia Experiment Station, Blacksburg, Montgomery County, Va.: Firm, light colored, No. 1; picked September 26, 1901, stored October 6; May 1, 1902, semi-firm, no scald or decay; kept unusually well for a northern variety and was of much better grade and color than most of the other sorts from same source.

Beach. Synonyms: *Apple of Commerce, Richardson's Red.*

W. S. Miller, Gerrardstown, Berkeley County, W. Va.: Bright, sound, No. 1; picked November 5, 1902, stored November 12; May 1, 1903, sound and in prime commercial condition.

Beauty of Kent. (See Kent Beauty.)

Bellflower. (See Yellow Bellflower.)

Ben Davis.

G. J. Dodd, Greenwood, Jackson County, Mo.: Hard, well colored, No. 1; picked October 1, 1902, stored October 4; March 10, 1903, in good market condition; scald and rot slight.

H. M. Dunlap, Southern Illinois: No. 1 stock; picked October 8, 1901, stored October 10; March 18, 1902, in fair market condition; somewhat injured by scald and decay.

G. G. Hitchings, South Onondaga, Onondaga County, N. Y.: Hard, medium sized, highly colored; trees 12 years old; picked October 22, 1901, stored October 26; May 1, 1902, firm and sound, no scald.

S. L. Lupton, Winchester, Frederick County, Va.: Firm, light colored, wormy; picked October 4, 1901, stored October 12; March 27, 1902, considerable scald, decay slight.

Ben Davis—Continued.

Massachusetts Agricultural College Experiment Station, Amherst, Hampshire County, Mass.: Small and hard; picked October 13, 1902, stored October 15; May 1, 1903, firm and sound.

W. S. Miller, Gerrardstown, Berkeley County, W. Va.: Firm, well colored, No. 1; picked October 2, 1901, stored October 18; May 1, 1902, firm, no rot or scald.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Small, hard, light colored; date of picking undetermined, stored November 12, 1902; May 1, 1903, semifirm, no scald or decay; similar in 1902.

Ozark Orchard Company, Goodman, McDonald County, Mo.: Medium to very large, well colored; picked October 10, 1902, stored October 28; March 10, 1903, overripe, slightly wilted, considerable decay.

F. H. Speakman, Neosho, Newton County, Mo.: Sound, well colored, No. 1; picked October 24, 1901, stored October 28; March 20, 1902, in good market condition, slight rot and scald.

G. E. Spohr, Manhattan, Riley County, Kans.: Small, poorly colored; picked October 11, 1901, stored October 18; March 20, 1902, badly shriveled, no decay or scald; received through Kansas Experiment Station.

Virginia Agricultural Experiment Station, Blacksburg, Montgomery County, Va.: Small, well colored, somewhat wormy; picked September 26, 1901, stored October 8; May 1, 1902, semifirm, no scald, decay slight.

Black Gilliflower. Synonym: *Gilliflower.*

G. G. Hitchings, South Onondaga, Onondaga County, N. Y.: Light colored, No. 1; trees about 100 years old; picked October 1, 1902, stored October 4; May 1, 1903, in prime commercial condition; similar for fruit picked in 1901.

Massachusetts Agricultural College Experiment Station, Amherst, Hampshire County, Mass.: Dull colored, No. 2; picked October 10, 1902, stored October 15; firm until January 1, 1903; decayed badly after February 1.

G. T. Powell, Ghent, Columbia County, N. Y.: Well colored, No. 1; picked October 16, 1902, stored October 19; February 1, 1903, badly injured by rot.

Black Oxford.

Z. A. Gilbert, Farmington, Franklin County, Me.: Hard, dull colored, No. 1; date of picking undetermined, stored November 10, 1902; May 1, 1903, firm, no scald or rot.

Blacktwig. (See Arkansas and Paragon.)

Bonum.

A. A. Boggs, Waynesville, Haywood County, N. C.: Bright, dark red, No. 1; picked September 15, 1902, stored September 26; May 1, 1903, firm, no rot or scald.

Borsdorf.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Small, light colored; picked September 19, 1902, stored September 27; March 14, 1903, soft, badly decayed.

Buckingham.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Small, hard, and immature; picked September 25, 1902, stored September 27; May 1, 1903, firm, no decay, scalds slight; commercial limit April 1.

Buler. Synonym: *Jonathan of Buler.*

New York Experiment Station, Geneva, Ontario County, N. Y.: Light red, No. 1; picked September 20, 1902, stored September 27; commercial limit February 1, 1903, after which fruit scalded badly, but remained firm till April 1.

Canada Red. (See Red Canada.)

Canada Reinette.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Hard, dull colored; picked October 12, 1901, stored October 19; May 1, 1902, mellow, no decay, scald slight; best commercial limit April 1.

Cannon Pearmain.

W. S. Miller, Gerrardstown, Berkeley County, W. Va.: Well colored, No. 1; picked October 12, 1901, stored October 18; May 1, 1902, in prime commercial condition, no scald or decay; a long keeper.

Virginia Agricultural Experiment Station, Blacksburg, Montgomery County, Va.: Hard, cloudy, somewhat wormy; picked October 3, 1901, stored October 5; May 1, 1902, firm, decay slight, no scald; commercial limit April 1.

Carlough.

W. S. Miller, Gerrardstown, Berkeley County, W. Va.: Hard, sound, No. 1; picked October 12, 1901, stored October 18; May 1, 1902, firm, no rot or scald; a long keeper.

Carthouse. (See Gilpin.)

Cayuga Redstreak. (See Twenty Ounce.)

Clarke.

New York State Experiment Station, Geneva, Ontario County, N. Y.: No. 1; picked October 12, 1901, stored October 21; February 1, 1902, mellow, no scald, decay slight; commercial limit December 1; flesh grows soft and mealy and discolors at end of commercial life.

Coffelt. Synonym: *Coffelt Beauty.*

W. S. Miller, Gerrardstown, Berkeley County, W. Va.: Hard, well colored, No. 1; picked October 11, 1901, stored October 18; May 1, 1902, firm, no scald or decay; a long keeper.

Coffelt Beauty. (See Coffelt.)

Cogswell.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Small, hard, and immature; picked October 3, 1902, stored October 11; May 1, 1903, firm, no scald or decay.

Colvert.

G. G. Hitchings, South Onondaga, Onondaga County, N. Y.: No. 1, picked October 1, 1902, stored October 4; firm until January 15, 1903.

Coon Red.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Small and immature; picked September 23, 1902, stored September 28; May 1, 1903, semi-firm, no decay, scald slight; commercial limit March 15.

Cooper Market.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Light colored, No. 1; picked October 12, 1901, stored October 21; May 1, 1902, hard and sound.

Crawford. Synonym: *Crawford Pippin.*

W. S. Miller, Gerrardstown, Berkeley County, W. Va.: Hard, well colored, No. 1; picked October 11, 1901, stored October 18; March 11, 1902, commencing to scald; May 1, 1902, firm, no decay, nearly all light-colored specimens scalded.

Crawford Pippin. (See Crawford.)

Crotts.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Hard and green; picked October 12, 1901, stored October 21; March 14, 1902, firm, no decay, badly scalded.

Cullen. Synonym: *Cullen's Keeper.*

Kansas Agricultural Experiment Station, Manhattan, Riley County, Kans.: Hard and green; picked October 7, 1901, stored October 10; May 1, 1902, firm, no scald or rot.

Cullen's Keeper. (See CULLEN.)

Deacon Jones.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Large, hard, bright, No. 1; picked October 4, 1902, stored October 11; May 1, 1903, mellow, free from scald and rot; commercial limit for barrel storage about March 1.

Delaware Red Winter. (See LAWYER.)

Dickenson.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Bright, No. 1; picked September 19, 1902, stored September 27; May 1, 1903; overripe and badly decayed; commercial limit February 1; commercial limit in 1901–2, March 1.

Disharoon.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Sound, No. 1; picked September 19, 1902, stored September 27; April 1, 1903, sound, but commencing to turn mellow, no scald or decay.

Doctor. Synonym: *Newby.*

Maine Agricultural Experiment Station, Orono, Penobscot County, Me.: Bright, clean, No. 1; picked October 7, 1901, stored October 10; May 1, 1902, firm, no scald, decay slight; commercial limit April 1 to 15.

Downing's Winter Maiden Blush. (See GREENVILLE.)

Duchess. (See OLDENBURG.)

Duchess of Oldenburg. (See OLDENBURG.)

Edwards.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Hard, green; picked October 12, 1901, stored October 21; May 1, 1902, hard and green, no scald or rot; sound, No. 1; picked September 20, 1902, stored September 27; March 14, 1903, quite mellow, no scald or rot.

Elgin Pippin. (See ELGIN.)

Esopus. Synonyms: *Esopus Spitzenburg; Spitzenburg.*

F. L. Bradley, Barker, Niagara County, N. Y.: Scabby and poorly colored; picked September 27, 1902, stored October 3; firm until March 1, 1903, when the fruit commenced to decay around scab spots.

G. G. Hitchings, South Onondaga, Onondaga County, N. Y.: Dark red, No. 1; trees about 100 years old; picked October 1, 1902, stored October 4; May 1, 1903, firm, no scald or decay.

New York State Experiment Station, Geneva, Ontario County, N. Y.: No. 1; picked October 21, 1902, stored October 27; May 1, 1903, semifirm, no decay or scald; in barrels should be sold April 1.

G. T. Powell, Ghent, Columbia County, N. Y.: Well colored, No. 1; picked October 16, 1902, stored October 19; in prime commercial condition until April 1, 1903, after which the fruit began to mellow; no rot.

The flesh of this variety becomes mealy when overripe.

Esopus Spitzenburg. (See ESOPUS.)

Ewalt.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Well colored, No. 1; picked October 6, 1902, stored October 11; March 14, 1903, beginning to mellow, decay slight, no scald; commercial limit in barrels February 1.

Excelsior.

Michigan Agricultural College Experiment Substation, South Haven, Van Buren County, Mich.: Light colored, No. 1; picked September 8, 1902, stored September 10; November 14, 1902, overripe, quality gone.

Fallawater.

G. G. Hitchings, South Onondaga, Onondaga County, N. Y.: Large, finely colored, No. 1; trees 12 years old; picked October 1, 1901, stored October 12; March 1, 1902, beginning to mellow; May 1, 1902, quite mellow but free from decay and scald; commercial limit February 1.

New York State Experiment Station, Geneva, Ontario County, N. Y.: No. 1, but very green; picked October 12, 1901, stored October 21; May 1, 1902, semifirm, no decay or scald; held in good semifirm condition for box storage from March 1 to May 1.

Fall Pippin.

Massachusetts Agricultural College Experiment Station, Amherst, Hampshire County, Mass.: Large, bright, No. 1; picked September 30, 1902, stored October 3; in firm condition until January 1, 1903, when the fruit began to mellow.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Bright, No. 1; picked September 24, 1902, stored September 29; January 27, 1903, commencing to soften. Fruit picked in 1901 kept in good condition until January 10, 1902; may be held in boxes till February 1.

Fall Queen. (See Haas.)

Fameuse. Synonym: *Snow.*

G. G. Hitchings, South Onondaga, Onondaga County, N. Y.: Well colored, No. 1; trees 12 years old; picked October 7, 1902, stored October 12; in good commercial condition until March 15, 1903. Fruit picked in 1901 kept in good condition until February 15, 1902.

Maine Agricultural Experiment Station, Orono, Penobscot County, Me.: Slight colored, No. 1; ripe and somewhat bruised; picked October 7, 1902, stored October 24; January 23, 1903, in good condition for box storage, no scald or decay; March 11, overripe and past commercial condition.

Massachusetts Agricultural College Experiment Station, Amherst, Hampshire County, Mass.: Bright, No. 1; picked September 30, 1902, stored October 3; February 15, firm, no scald or rot; commercial limit about March 1.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Hard, bright, No. 1; picked October 12, 1901, stored October 21; January 31, 1902, mellow, no decay or scald; March 14, very ripe but still sound.

Geo. T. Powell, Ghent, Columbia County, N. Y.: Bright, dark red, No. 1; picked October 13, 1902, stored October 19; February 1, 1903, in prime commercial condition; March 1, mellow, free from scald and decay.

This variety reaches its commercial limit usually between January 1 and March 1.

Fanny.

Michigan Agricultural College Experiment Substation, South Haven, Van Buren County, Mich.: No. 1, highly colored; picked September 2, 1902, stored September 3; firm, sound, and beautifully colored November 14, 1902; would probably have held in good condition several weeks longer.

Fishkill.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Large, sound, well colored; picked October 4, 1901, stored October 11; began to decay internally, while still firm outside, after January 1–15, 1902; behavior similar in 1902–3.

Gano.

New York Experiment Station, Geneva, Ontario County, N. Y.: Small, hard, half colored; picked September 27, 1902, stored October 1; May 1, 1903, semifirm, some rot; commercial limit April 1.

Ozark Orchard Company, Goodman, McDonald County, Mo.: Very large, highly colored; picked October 6, 1902, stored October 11; March 11, 1903, overripe, 18 per cent decay; behavior similar in 1901–2; commercial limit February 1.

G. E. Spohr, Manhattan, Riley County, Kans.: Fruit large, well colored, firmer than Ozark Orchard stock; picked October 1, 1901, stored October 6; March 20, 1902, firm, no decay or scald; would probably have kept well a month longer; received through Kansas Experiment Station.

Virginia Agricultural Experiment Station, Blacksburg, Montgomery County, Va.: Well colored, firm, medium grade, considerable codling-moth injury; picked September 26, 1901, stored October 16; February 1, 1902, firm, with no decay or scald, after which the decay proceeded quite rapidly.

Geniton. (See Ralls.)

Gibb.

W. S. Miller, Gerrardstown, Berkeley County, W. Va.: Hard, No. 1; picked October 2, 1901, stored October 18; May 1, 1902, in prime commercial condition, no scald or decay; a long keeper.

Gideon.

Michigan Agricultural College Experiment Substation, South Haven, Van Buren County, Mich.: Hard, light colored, rather immature; picked September 9, 1902, stored September 10, 1902; November 14, 1902, firm, sound; commercial limit probably January 1.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Bright, No. 1; picked October 12, 1901, stored October 21, 1901; commercial limit January 1, 1902; after that the flesh began to discolor at the core, a characteristic of this variety after it reaches maturity.

Gilliflower. (See Black Gilliflower.)

Gilpin. Synonym: *Carthouse.*

G. G. Hitchings, South Onondaga, Onondaga County, N. Y.: Medium sized, bright, half colored, very hard; trees 28 years old; picked after October 1, 1901; stored October 12, 1901; began to scald March 15, 1902, and scalded badly, but remained hard through storage season; behavior similar in 1902–3, except scalding began a month later.

Gold Medal. Synonym: *Golden Medal.*

New York State Experiment Station, Geneva, Ontario County, N. Y.: Hard, green, good; picked October 3, 1901, stored October 11; commercial limit February 1 to 15, 1902, after which the fruit softened; no scald.

Golden Medal. (See Gold Medal.)

Golden Russet (N. Y.).

Maine Agricultural Experiment Station, Orono, Penobscot County, Me.: Bright, hard, well russeted, No. 1; picked October 7, 1901, stored October 24, 1901; commercial limit May 1, 1902, when stock was hard, but mellowing began soon after.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Hard, greenish russet, No. 1; picked October 24, 1902, stored November 15; May 1, 1903, prime commercial condition, no decay; similar in 1901–2, but by June 1 the fruit was mellow and decay was setting in.

Gravenstein.

Michigan Agricultural College Experiment Substation, South Haven, Van Buren County, Mich.: No. 1, quite well colored; picked September 9, 1902, stored September 11; November 14, 1902, ripe, but still firm, quality good; should be sold by November 1.

New York State Experiment Station, Geneva, Ontario County, N. Y.: No. 1, highly colored; picked September 18, stored September 27, 1902; commercial limit December 1, 1902, after which it softened; no scald.

Green Crimean.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Hard, sound; picked October 4, 1902, stored October 11; May 1, 1903, firm, in good commercial condition; no scald or decay.

Green Newtown. Synonym: *Newtown Pippin.*

New York State Experiment Station, Geneva, Ontario County, N. Y.: No. 1; picked October 12, 1901, stored October 21; in March, 1902, it was too green for use; May 1 hard, no decay, scald slight.

Green Sweet.

W. S. Miller, Gerrardstown, Berkeley County, W. Va.: No. 1; picking date undetermined; stored October 18, 1901; commercial limit March 1 to 15, 1902, when it began to mellow; no scald.

Greening. (See Rhode Island.)

Greenville. Synonym: *Downing's Winter Maiden Blush.*

New York State Experiment Station, Geneva, Ontario County, N. Y.: Large, finely colored, No. 1; picked October 12, 1901, stored October 21, 1901; in excellent commercial condition till February 1, 1902, when scald began to develop; one-third scalded March 14, 1902.

Grimes. Synonym: *Grimes Golden.*

W. S. Miller, Gerrardstown, Berkeley County, W. Va.: Bright, No. 1; picked September 20, 1901, stored October 16; mellow when stored; began to deteriorate from decay after January 1, 1902.

New York State Experiment Station, Geneva, Ontario County, N. Y.: No. 1, fair color; picked October 2, 1902, stored October 11; in good condition commercially till February 1, 1903, when scald began to develop; May 1, all scalded, semifirm.

Virginia Agricultural Experiment Station, Blacksburg, Montgomery County, Va.: No. 2; considerable codling-moth injury; picked September 26, 1901, stored October 16; limit December 1, 1901, after which the fruit rotted badly; scald began to develop in March, 1902; probably injured by delay in storage.

Grimes Golden. (See Grimes.)

Haas. Synonym: *Fall Queen.*

Maine Agricultural Experiment Station, Orono, Penobscot County, Me.: Well colored, No. 1; picked September 16, 1901, stored October 24; semifirm when stored; commercial limit December 1, 1901, after which the flesh began to soften throughout.

Massachusetts Agricultural College Experiment Station, Amherst, Hampshire County, Mass.: Mixed grade, well colored; picked September 3, 1902; stored October 3; firm till December 1, 1902, after which the flesh became mealy; no scald.

New York State Experiment Station, Geneva, Ontario, County, N. Y.: Fair colored, No. 1; picked September 7, 1902, stored September 27; after December 1, 1902, the flesh began to mellow, grow mealy, and decay.

Haskell.

New York State Experiment Station, Geneva, Ontario County, N. Y.: No. 1; picked October 1 to 12, 1901, stored October 21; commercial limit January 15, 1902, after which the fruit began to soften; no scald.

Haskell Sweet. (See HASKELL.)

Henniker. Synonym: *Lady Henniker.*

New York State Experiment Station, Geneva, Ontario County, N. Y.: Well colored, No. 1; picked September 9, 1902, stored September 27; after December 1, 1902, the flesh began to mellow; no scald.

Highfill. Synonym: *Hyfill.*

Ozark Orchard Company, Goodman, McDonald County, Mo.: Large, No. 1; highly colored; picked October 20, 1902, stored October 28; March 10, 1903, semifirm, slightly shriveled, one-third decayed; no scald; commercial limit probably January 15.

Holland. Synonym: *Holland Pippin.*

G. G. Hitchings, South Onondaga, Onondaga County, N. Y.: Large, bright, No. 1; picked September 1, 1902, stored September 29; after December 1, 1902, the flesh began to soften; no scald.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Large, well colored, No. 1; picked October 12, 1901, stored October 21; after February 1, 1902, the fruit began to soften; no scald till long after its commercial season.

Holland Pippin. (See HOLLAND.)

Hubbardston. Synonyms: *Hubbardston Nonesuch, Nonesuch.*

Z. A. Gilbert, Farmington, Franklin County, Me.: Medium size, well colored, mixed grade; picking date undetermined, stored November 10, 1902; after December 1, 1902, the flesh softened throughout; probably ripe when stored.

G. G. Hitchings, South Onondaga, Onondaga County, N. Y.: Large, finely colored, considerable codling-moth injury; trees six years old; picked October 5, 1902, stored October 12; prime commercial condition till February 1, 1903, when it began to shrivel; April 1, soft.

Kansas Agricultural Experiment Station, Manhattan, Riley County, Kans.: Medium to small, pale greenish red; picked October 8, 1901, stored October 12; no softening and but little decay till April 1, 1902; fruit began to wilt after February 1, 1902.

Massachusetts Agricultural College Experiment Station, Amherst, Hampshire County, Mass.: Medium size, rather dull color; picked September 30, 1902, stored October 3; good commercial condition for barrel storage till January 15, 1903; for box storage till February 15, 1903, after which the fruit mellowed and became mealy.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Small, hard, immature; picked October 4, 1902, stored October 11; prime condition May 1, 1903.

G. T. Powell, Ghent, Columbia County, N. Y.: Very large, overgrown, highly colored; picked October 4, 1902, stored October 9; firm till December 1, 1902, after which the flesh grew mealy; January 15, 1903, all burst.

The flesh of this variety usually becomes mealy when it passes maturity

Hubbardston Nonesuch. (See HUBBARDSTON.)

Huntsman. Synonym: *Huntsman Favorite.*

G. J. Dodd, Greenwood, Jackson County, Mo.: Well-colored, No. 1; picked October 1, 1902, stored October 4; March 10, 1903, all scalded slightly, but very firm; commercial limit, February 1, 1903.

Huntsman—Continued.

H. M. Dunlap, Southern Illinois: Well-colored, No. 1; picked October 8, 1901, stored October 10; prime commercial condition till February 1, 1902, after which scald appeared.

W. S. Miller, Gerrardstown, Berkeley County, W. Va.: Highly colored, No. 1; picked October 9, 1901, stored October 18; in prime commercial condition June 1, 1902, hard, bright yellow; no scald or decay.

Huntsman Favorite. (See HUNTSMAN.)

Hurlbut.

Maine Agricultural Experiment Station, Orono, Penobscot County, Me.: Bright, well-colored, No. 1; picked October 7, 1901, stored October 24; good condition till February 1, 1902, when scald and decay began to develop; semifirm when stored.

Massachusetts Agricultural College Experiment Station, Amherst, Hampshire County, Mass.: Medium sized, fair color; picked September 20, 1902, stored October 3, 1902; firm till February 15, 1903; no scald or rot; would probably have kept well a month longer in boxes.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Hard, not well colored; picked September 12, 1902, stored September 27; firm till April 1, 1903, after which the flesh softened.

Hyfill. (See HIGHFILL.)

Ingram.

W. T. Flournoy, Marionville, Lawrence County, Mo.: Hard, well-colored, No. 1; picked October 10, 1902, stored October 18; March 10, 1903, in prime commercial condition, firm, free from scald and rot; would have kept a number of weeks longer.

Ivanhoe.

W. S. Miller, Gerrardstown, Berkeley County, W. Va.: Well-colored, No. 1; picked November 5, 1901, stored November 12; prime commercial condition till June 1, 1902, when wilting began; no scald or rot.

Virginia Agricultural Experiment Station, Blacksburg, Montgomery County, Va.: Hard, fair grade, considerable "flyspeck" fungus and codling-moth injury; picked September 30, 1901, stored October 16; no rot or scald throughout storage season, but fruit wilted so as to injure its commercial value after February 1, 1902.

Jacobs. Synonym: *Jacobs Sweet.*

New York State Experiment Station, Geneva, Ontario County, N. Y.: Green, No. 1; picked September 9, 1901, stored September 27; firm till March 1, 1902, good condition for box storage till April 1; no scald. The crop of 1902 began to mellow February 1, but it held in good condition for box storage till April 1.

W. S. Miller, Gerrardstown, Berkeley County, W. Va.: Large, clear, No. 1; picked October 11, 1901, stored October 18; in prime condition till April 1, 1902, after which the fruit softened.

Jacobs Sweet. (See JACOBS.)

Jefferis.

Michigan Agricultural College Experiment Substation, South Haven, Van Buren County, Mich.: Well-colored, No. 1; picked September 2, 1902; stored September 3; November 14, 1902, bright in appearance, but quality poor; commercial limit probably October 15.

Johnson's Fine Winter. (See YORK IMPERIAL.)

Jonathan.

G. J. Dodd, Greenwood, Jackson County, Mo.: Large, well colored, firm, No. 1; picked September 22, 1902, stored September 24; commercial limit probably February 1, 1903; March 11, 1903, 20 per cent decayed.

Jonathan—Continued.

G. G. Hitchings, South Onondaga, Onondaga County, N. Y.: Dark red, bright, No. 1; trees 6 years old; picked October 5, 1901, stored October 12; in prime condition for barrel storage till April 1, 1902; in good condition for box storage till June 1, 1902; no rot; held well for a long time after the fruit began to mellow.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Small, hard, considerably russeted; picked October 23, 1902, stored October 27; May 1, 1903, hard, no rot, in prime commercial condition.

G. T. Powell, Ghent, Columbia County, N. Y.: Medium sized, highly colored; picked October 16, 1902, stored October 19; in prime condition for barrel storage till March 1, 1903, when it began to mellow; good condition for box storage till May 1; no rot or scald.

F. H. Speakman, Neosho, Newton County, Mo.: Large, highly colored, No. 1; picked September 25, 1901, stored October 16; commercial limit about February 1, 1902; when inspected March 20 the fruit was mellow, with considerable decay; probably injured by delayed storage.

G. E. Spohr, Manhattan, Riley County, Kans.: Well colored, No. 1; picked October 1, 1901, stored October 12; prime till February 1, 1902, when the fruit began to mellow; received through Kansas Experiment Station.

Jonathan of Buler. (See Buler.)

Jones Seedling.

W. S. Miller, Gerrardstown, Berkeley County, W. Va.: Clear colored, No. 1; picked November 5, 1901, stored November 12; good commercial condition till March 1, 1902, when scald developed; firm throughout storage season.

Kansas.

W. S. Miller, Gerrardstown, Berkeley County, W. Va.: Highly colored, No. 1; picked October 8, 1901, stored October 18; in prime commercial condition throughout storage season; no rot or scald.

Kansas Keeper.

New York Experiment Station, Geneva, Ontario County, N. Y.: Very hard, immature; picked October 2, 1901, stored October 21; hard, with no scald or decay June 1, 1902.

Kent Beauty. Synonym: *Beauty of Kent.*

Massachusetts Agricultural College Experiment Station, Amherst, Hampshire County, Mass.: Large, well colored, No. 1; picked September 30, 1902, stored October 31; kept well till January 1, 1903, after which the flesh softened and became mealy; no scald.

King. (See Tompkins King.)

Kirtland.

New York State Experiment Station, Geneva. Ontario County, N. Y.: Dark red, No. 1; picked October 12, 1901, stored October 21; prime commercial condition throughout the storage season; no scald or decay.

Lady Henniker. (See Henniker.)

Lady Sweet.

G. G. Hitchings, South Onondaga, Onondaga County, N. Y.: Bright, clear, medium sized, three-fourths red, No. 1; picked October 1, 1902, stored October 4; May 1, 1903, prime commercial condition, firm, no rot or scald.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Hard, half-green, immature; picked October 21, 1902, stored October 27; hard and sound through storage season.

G. T. Powell, Ghent, Columbia County, N. Y.: Fancy large, bright red, from young trees; picked October 16, 1902, stored October 19; prime condition for barrel storage till March 15, 1903, when fruit began to mellow; good condition for box storage till May 1; no scald or decay.

Lankford.

S. H. Derby, Woodside, Kent County, Del.: Large, well colored No. 1; picked September 29, 1902, stored October 30; began to scald January 15, 1903, and firm till March 1.

W. S. Miller, Gerrardstown, Berkeley County, W. Va.: Bright, No. 1, well colored; picked October 12, 1901, stored October 18; began scalding January 15, 1902, but remained hard, with no decay, till June 1.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Medium sized, very hard, half colored; picked October 12, 1901, stored October 21; began scalding in January, 1902, but remained hard through storage season.

Virginia Agricultural Experiment Station, Blacksburg, Montgomery County, Va.: Medium grade, considerable injury from codling moth and "flyspeck" fungus; picked September 26, 1901, stored October 16; began scalding April 1, 1902; semi-firm after February 1, 1902.

This apple is usually one of the worst scalding varieties after midwinter.

Lansberger Reinette.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Bright, No. 1; picked October 12, 1901, stored October 21; commercial limit January 15, 1902, after which the flesh mellowed; no scald.

Lawver. Synonym: *Delaware Red Winter.*

Near Kansas Agricultural Experiment Station, Manhattan, Riley County, Kans.: No. 1, rather dull red; picked October 21, 1901, stored October 18; good commercial condition March 20, 1902, and apparently would have kept well throughout storage season; received through Kansas Experiment Station.

Massachusetts Agricultural College Experiment Station, Amherst, Hampshire County, Mass.: Small, dull red, very hard; picked October 11, 1902, stored October 15; May 1, 1903, hard, no scald or decay.

W. S. Miller, Gerrardstown, Berkeley County, W. Va.: Large, bright, dark red; picked October 11, 1901, stored October 16; good commercial condition till March 15, 1902, when some of the apples began to grow mealy; ripened unevenly; fruit overgrown.

Virginia Agricultural Experiment Station, Blacksburg, Montgomery County, Va.: Small, No. 2; considerably injured by codling moth; picked September 27, 1901, stored October 16; May 1, 1902, hard and in good condition; a few decayed from bruising.

Leicester.

Massachusetts Agricultural College Experiment Station, Amherst, Hampshire County, Mass.: Large, dull yellow, with blush; picked September 30, 1902, stored October 3; after January 1, 1903, the flesh became mealy; no scald.

Limbertwig.

Near Kansas Agricultural Experiment Station, Manhattan, Riley County, Kans.: Small, greenish-red, immature; picked October 15, 1901, stored October 10; very hard throughout storage season; no rot or scald; fruit received through Kansas Agricultural Experiment Station.

Longfield.

Maine Agricultural Experiment Station, Orono, Penobscot County, Me.: Clear, No. 1; mellow when stored; picked September 16, 1901, stored October 24; at end of commercial season when stored.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Clear, well colored, No. 1; picked October 12, 1901, stored October 21, semifirm when stored; commercial limit December 1, 1901, after which the flesh grew mealy.

Lowell.

New York State Experiment Station, Geneva, Ontario County, N. Y.: No. 1; picked September 2, 1902, stored September 3; commercial limit October 15, 1902, after which it softened and lost quality.

Loy.

Kansas Agricultural Experiment Station, Manhattan, Riley County, Kans.: Pale, greenish-red, grade No. 1; picked October 4, 1901, stored October 9; March 10, 1902, considerably wilting, no scald, decay slight; commercial limit March 1, 1902.

W. S. Miller, Gerrardstown, Berkeley County, W. Va.: Well colored, No. 1; picked October 9, 1901, stored October 18; May 1, 1902, prime commercial condition, firm, no rot or scald.

McIntosh. Synonym: *McIntosh Red.*

G. G. Hitchings, South Onondaga, Onondaga County, N. Y.: Well colored, No. 1; trees 12 years old; picked October 7, 1901, stored October 12; firm till January 15, 1902, after which it became mellow; behavior similar in 1902–1903.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Well colored, No. 1; picked October 12, 1901, stored October 21; firm till January 15, 1902; good condition for box storage till March 1, 1902; in 1902–1903 the fruit was firm a month longer.

McIntosh Red. (See McIntosh.)

McMahon. Synonym: *McMahon White.*

New York State Experiment Station, Geneva, Ontario County, N. Y.: No. 1; unevenly colored; picked October 12, 1901, stored October 21; commercial limit December 1, 1901; ripens unevenly.

McMahon White. (See McMahon.)

Magog.

New York State Experiment Station, Geneva, Ontario County, N. Y.: No. 1; picked September 18, 1902, stored September 27; commercial limit January 15, 1902, after which the flesh softened; no scald.

Maiden Blush.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Well colored, No. 1; picked October 12, 1901, stored October 21; after December 15, 1901, the flesh softened; behavior similar in 1902; no scald.

Mammoth Blacktwig. (See Arkansas.)

Manchester.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Small, immature, very hard; picked September 20, 1902, stored September 27; May 1, 1903, hard, immature; no scald or rot.

Mann.

W. T. Mann, Barker, Niagara County, N. Y.: Large, bright, clear, No. 1; soil sandy; picked October 24, 1902, stored October 25; May 1, 1903, yellowish, bright, hard; no rot or scald; from clay soil, greener and less attractive at end of storage season.

Massachusetts Agricultural College Experiment Station, Amherst, Hampshire County, Mass.: Medium size, grassy green, dull; picked October 11, 1902, stored October 15; May 1, 1903, very hard and green; no rot or scald.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Small, hard, grassy green; picked October 3, 1902, stored October 11; May 1, 1903, hard and green; no rot or scald.

Manwaring.

New York State Experiment Station, Geneva, Ontario County, N. Y.: No. 1; picked September 27, 1902, stored October 1; commercial limit January 15, 1903, after which it decayed badly.

Marigold.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Immature, small; picked October 6, 1902, stored October 11; May 1, 1903, very hard; no decay, scald slight.

Marmalade.

Michigan Agricultural College Experiment Substation, South Haven, Van Buren County, Mich.: No. 1; picked August 22, 1902, stored September 3; probably semifirm when stored; November 14, 1902, semifirm; quality poor; no rot.

Melon. Synonym: *Norton's Melon.*

New York State Experiment Station, Geneva, Ontario County, N. Y.: Hard, green; picked October 12, 1901, stored October 21; May 1, 1902, still hard and green; no scald or rot; in 1902–1903 the fruit softened after February 1 and decayed considerably.

Milden. Synonym: *Milding.*

Z. A. Gilbert, Farmington, Franklin County, Me.: Medium size, well colored, No. 1; picking date undetermined, stored November 10, 1902; firm till March 1, 1903; in good condition for box storage till May 1, 1903; no scald, slight decay from bruising.

Maine Agricultural Experiment Station, Orono, Penobscot County, Me.: Large, bright No. 1; picked October 7, 1901, stored October 24, semifirm at storing time; held semifirm and in good condition for storage in boxes till May 1, 1902, after which it softened and decayed.

Milding. (See Milden.)

Milligen.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Firm, No. 1; picked October 6, 1902, stored October 11; after January 15, 1903, scald appeared, though the fruit was firm with slight scald till March 15.

Minkler.

H. M. Dunlap, Southern Illinois: No. 1; picked October 4, 1901, stored October 10; good commercial condition till February, 1902; March 17 nearly one-fourth scalded, but fruit firm; considerable decay.

Missouri. Synonym: *Missouri Pippin.*

F. H. Speakman, Neosho, Newton County, Mo.: Large, highly colored, No. 1; picked October 20, 1901, stored October 30; March 20, 1902, prime commercial condition, hard, no scald or decay; behavior similar in 1903; commercial limit probably April 15 to May 1.

Virginia Agricultural Experiment Station, Blacksburg, Montgomery County, Va.: No. 2, scabby, considerable "flyspeck" fungus and codling-moth injury; picked September 26, 1901, stored October 16; firm till March 1, 1902, after which the fruit decayed badly.

Missouri Pippin. (See Missouri.)

Monmouth.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Bright, green, No. 1; picked October 12, 1901, stored October 21; May 1, 1902, in prime commercial condition; firm, no rot or scald; behavior similar in 1902–1903; commercial limit about June 1.

Moore Sweet.

New York State Experiment Station, Geneva, Ontario County, N. Y.: No. 1, immature; picked October 12, 1901, stored October 21; firm, with no decay or scald till April 15, 1902, after which it softened.

Mother.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Firm, poorly colored, No. 1; picked September 17, 1902, stored September 27, firm till March 15; semifirm and in good condition for storage in boxes till May 1, 1903; no decay or scald.

Munson. Synonym: *Munson Sweet.*

Maine Agricultural Experiment Station, Orono, Penobscot County, Me.: Clear yellow, No. 1; ripe when stored; picked September 16, 1901, stored October 24; the fruit, though semifirm, held in good condition with no rot or scald till February 5, 1902, after which it softened.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Fair colored, No. 1; picked September 25, 1902, stored September 29; in good condition till January 1, 1903, after which it softened; no scald or decay.

Munson Sweet. (See Munson.)

Nansemond. Synonym: *Nansemond Beauty.*

Virginia Agricultural Experiment Station, Blacksburg, Montgomery County, Va.: No. 2, small, light in color, injured by codling moth; picked September 24, 1901, stored October 16; in good condition till February 1, 1902, after which both decay and scald appeared.

Nansemond Beauty. (See Nansemond.)

Nero.

W. S. Miller, Gerrardstown, Berkeley County, W. Va.: Large, not well colored, immature; picked September 27, 1901, stored October 18; semifirm when stored, in good condition till March 1, 1902, after which the fruit softened and scald appeared. The delay in storing undoubtedly shortened its storage period.

Virginia Agricultural Experiment Station, Blacksburg, Montgomery County, Va.: No. 2, badly affected with codling moth, well colored; picked September 26, 1901, stored October 16; after February 1 the fruit decayed considerably, though still firm; scald appeared March 1, 1902.

This variety is inclined to scald considerably after midwinter, unless it is highly colored.

Neverfail. (See Ralls Genet.)

Newby. (See Doctor.)

Newman.

New York State Experiment Station, Geneva, Ontario County, N. Y.: No. 1; picked October 12, 1901, stored October 21; May 1, 1902, firm, in prime commercial condition; no decay or scald.

Newtown Pippin. (See Green Newtown and Yellow Newtown.)

Newtown Spitzenburg.

G. G. Hitchings, South Onondaga, Onondaga County, N. Y.: Large, highly colored, No. 1; trees 100 years old; picked October 5, 1901, stored October 8; in good condition for barrel storage till March 15; semifirm and in good condition for storage in boxes till April 15, 1902; no scald or rot.

G. T. Powell, Ghent, Columbia County, N. Y.: Medium sized, bright, light colored, No. 1; picked October 13, 1902, stored October 19; in good condition for barrel storage till February 15, when the fruit began to mellow; good condition for box storage till March 15, 1903, after which the flesh became mealy, and later the fruit burst; no scald or decay.

New Water.

New York State Experiment Station, Geneva, Ontario County, N. Y.: No. 1; picked October 12, 1901, stored October 21; firm till January 15, 1902; in good condition till March 1; no decay or scald.

Nonesuch. (See HUBBARDSTON.)

Northern Spy.

F. L. Bradley, Barker, Niagara County, N. Y.: Poor grade, light colored; picked October 9, 1902, stored October 15; May 1, 1903, firm and in good condition; no rot or scald.

A. A. Boggs, Waynesboro, Haywood County, N. C.: Large, dark red, fancy; picked September 25, 1902, stored September 30; firm until December 1, 1902, after which it decayed and softened rapidly.

G. G. Hitchings, South Onondaga, Onondaga County, N. Y.: Large, highly colored, fancy; trees 6 years old; picked October 22, 1901, stored October 26; May 1, 1902, prime commercial condition, firm, no scald, slight rot.

New York State Experiment Station, Geneva, Ontario, County, N. Y.: Well colored, No. 1; picked October 12, 1901, stored October 21; May 1, 1902, firm, good commercial condition. Picked November 3, 1902, stored November 15; light colored; in good condition till March 1, 1903, after which the fruit decayed considerably.

G. T. Powell, Ghent, Columbia County, N. Y.: Fancy, medium size, dark red; picked October 16, 1902, stored October 19; May 1, 1903, hard, no rot or decay, and in prime condition.

This variety is variable in its storage behavior. It is particularly susceptible to decay from blue mold, especially if bruised or delayed in reaching storage. If well colored, picked, packed, and handled with great care, and stored soon after picking, it may be carried in storage as long as most winter varieties.

Northwestern Greening.

W. S. Miller, Gerrardstown, Berkeley County, W. Va.: Well colored, No. 1; picked October 11, 1901, stored October 18; May 1, 1902, hard, no scald or decay, in prime commercial condition.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Medium size, No. 1; picked October 12, 1901, stored October 21; May 1, 1902, hard, no scald or decay; good commercial condition till June 1, 1902, when it began to soften.

Norton's Melon. Synonym of Melon.

Oakland. Synonym: *Oakland Seeknofurther.*

New York State Experiment Station, Geneva, Ontario County, N. Y.: Bright, hard, No. 1; picked October 12, 1901, stored October 21; firm till March 1, 1902; semifirm, in good condition for box storage till April 15; no decay or scald.

Oakland Seeknofurther. (See OAKLAND.)

Oldenburg. Synonym: *Duchess of Oldenburg.*

J. F. Taylor, Douglas, Allegan County, Mich.: Hard, light colored, No. 1; picked August 20, 1902, stored August 21; November 14, 1902, in prime market condition, less than 1 per cent of rot, no shrinkage; commercial limit probably about December 15.

Oliver. Synonym: *Senator.*

W. S. Miller, Gerrardstown, Berkeley County, W. Va.: No. 1; picked November 4, 1901, stored November 12, semifirm when stored; May 1, 1902, semifirm, decay slight, no scald; commercial limit probably late in spring when stored firm.

Ontario.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Hard, green, No. 1; picked October 2, 1902, stored October 11; March 14, 1903, firm, no decay or scald; May 1, soft and worthless.

Ornament. Synonym: *Ornament de Table.*

New York State Experiment Station, Geneva, Ontario County, N. Y.: Small, light colored; picked September 22, 1902, stored September 27; May 1, 1903, firm, decay slight, no scald. Fruit picked in 1901 in similar condition May 1, 1902.

Ornament de Table. (See Ornament.)

Palmer Greening. (See Washington Royal.)

Paragon. Synonym: *Blacktwig.*

New York State Experiment Station, Geneva, Ontario County, N. Y.: Hard, green, No. 1; picked October 12, 1901, stored October 21; March 14, 1902, firm, but badly scalded; May 1, nearly all scalded, firm, no decay.

Peck Pleasant.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Hard and green; picked October 4, 1902, stored October 11; May 1, 1903, firm, no decay, scald slight.

Virginia Agricultural Experiment Station, Blacksburg, Montgomery County, Va.: No. 1, somewhat cloudy and wormy; picked September 26, 1901, stored October 6; January 24, 1902, semifirm, no scald or decay; May 1, past best commercial condition, considerable rot; commercial limit March 1.

Peter.

Michigan Agricultural College Experiment Substation, South Haven, Van Buren County, Mich.: Hard, well colored, No. 1; picked September 9, 1902, stored September 10; November 14, 1902, in prime market condition, firm and sound; commercial limit probably January 1.

Pewaukee.

G. G. Hitchings, South Onondaga, Onondaga County, N. Y.: Well colored, No. 1; trees 12 years old, picked September 25, 1902, stored September 29; May 1, 1903, firm, no rot or scald. Fruit picked in 1901 kept in similar condition.

Maine Agricultural Experiment Station, Orono, Penobscot County, Me.: Well colored, No. 1; picked October 7, 1902, stored October 24; May 1, 1903, firm, decay slight, no scald.

Massachusetts Agricultural College Experiment Station, Amherst, Hampshire County, Mass.: Well colored, No. 1; picked October 8, 1902, stored October 12; May 1, 1903, firm, no scald or decay.

W. S. Miller, Gerrardstown, Berkeley County, W. Va.: Well colored, No. 1; picked October 8, 1901, stored October 18; May 1, 1902, no scald or rot, firm.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Small, hard, and undercolored; picked October 4, 1902, stored October 11; May 1, 1903, hard and green, no rot; fruit picked in 1901 kept in similar condition.

Phoenix.

G. G. Hitchings, South Onondaga, Onondaga County, N. Y.: Poor, scabby, light red; picked October 1, 1902, stored October 4; May 1, 1903, hard, no scald or rot. Identity uncertain.

Piper.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Hard, green, No. 1; picked October 12, 1901, stored October 21; May 1, 1902, hard, no scald or decay.

Pound Sweet. (See Pumpkin Sweet.)

Pride of Texas. (See Texas.)

Pryor. Synonym: *Pryor Red.*

W. S. Miller, Gerrardstown, Berkeley County, W. Va.: Hard, No. 1; picked October 11, 1901, stored October 18; May 1, 1902, firm, free from rot and scald.

Pryor Red. (See Pryor.)

Pumpkin Russet.

New York State Experiment Station, Geneva, Ontario County, N. Y.: No. 1; picked September 17, 1902; stored September 27; January 6, 1903, a little past commercial condition, commencing to soften.

Pumpkin Sweet. Synonyms: *Pound Sweet; Lyman's Pumpkin Sweet.*

G. G. Hitchings, South Onondaga, Onondaga County, N. Y.: Large, well colored, but many water-cored; trees 10 years old; picked October 1, 1902, stored October 4; in good condition until January 15, 1903, when the fruit began to soften and decay; fruit picked in 1901 kept in similar condition.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Medium sized, hard, and green; picked October 2, 1902, stored October 11; May 1, 1903, firm, decay slight, no scald; received as Pumpkin Sweet.

George T. Powell, Ghent, Columbia County, N. Y.: Large, No. 1; picked October 6, 1902, stored October 9; in good commercial condition until January 1, 1903, when the fruit began to decay.

This variety often discolors in flesh after it reaches a ripe condition, but the texture remains firm after the discoloration takes place.

Quince *Cole.*

Michigan Agricultural College Experiment Substation, South Haven, Van Buren County, Mich.: Sound, No. 1; picked September 2, 1902, stored September 3; November 14, 1902, semifirm, quality somewhat impaired, no decay or scald; commercial limit November 1.

Ralls. Synonyms: *Geniton; Ralls Genet; Neverfail.*

H. M. Dunlap, Southern Illinois: Small, imperfect, No. 2; picked October 9, 1901, stored October 15; January 17, 1902, firm, no decay or scald; March 18, considerable decay and some scald.

W. S. Miller, Gerrardstown, Berkeley County, W. Va.: Bright, clean, No. 1; picked October 12, 1901, stored October 18; May 1, 1902, in prime condition, no rot, or decay.

Ralls Genet. (See RALLS.)

Rambo.

H. M. Dunlap, Southern Illinois: Well colored, No. 1; picked October 9, 1901, stored October 15; January 17, 1902, quite ripe, but free from decay and scald; March 18, overripe and commencing to soften.

G. G. Hitchings, South Onondaga, Onondaga County, N. Y.: Well colored, No. 1; trees about 100 years old; picked October 1, 1902, stored October 6; in prime commercial condition until April 1, 1903, when the fruit began to soften. Fruit picked in 1901 kept in similar condition.

Red Canada. Synonyms: *Canada Red; Steele's Red Winter.*

G. G. Hitchings, South Onondaga, Onondaga County, N. Y.: Dark red, No. 1; trees 6 years old; dates of picking and storing undetermined; in prime commercial condition until April 15, 1902, after which date the fruit softened very quickly.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Immature, hard, No. 1; picked October 12, 1901, stored October 21; May 1, 1902, firm, free from scald and decay.

Red Russet.

Massachusetts Agricultural College Experiment Station, Amherst, Hampshire County, Mass.: Dull colored, wormy, No. 2; picked October 13, 1902, stored October 15; May 1, 1903, firm, no scald or decay.

Red Winter Sweet.

George T. Powell, Ghent, Columbia County, N. Y.: Bright, No. 1; picked October 13, 1902, stored October 19; March 1, 1903, quite mellow, no scald or decay.

Reinette Pippin.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Hard, immature, No. 1; picked October 1, 1902, stored October 11; March 14, 1903, firm, no scald, decay slight; May 1, semifirm, quality good, considerable decay. Fruit picked in 1901 reached its commercial limit February 1, 1902, and by March 14 was badly scalded and specked with rot.

Rhode Island.

F. L. Bradley, Barker, Niagara County, N. Y.: Firm, poorly graded; picked September 27, 1902, stored October 3; in commercial condition until March 15, 1903; May 1, injured by scald and decay.

J. E. Brown, Wilson, Niagara County, N.Y.: Not closely graded; many small and wormy fruits; dates of picking and storing undetermined; March 13, 1902, considerable scald, decay slight.

G. G. Hitchings, South Onondaga, Onondaga County, N.Y.: Bright, dark green, No. 1; picked October 7, 1901, stored October 12; in prime commercial condition until March 15, 1902, when the fruit began to scald; May 1, firm but badly scalded. Fruit picked in 1902 kept in similar condition.

Z. A. Gilbert, Farmington, Franklin County, Me.: Small, green, fair, No. 1; picking date undetermined, stored November 14, 1902; May 1, 1903, in good commercial condition, free from scald and decay.

W. T. Mann, Barker, Niagara County, N. Y.: Bright, large, No. 1; from heavy soil, very green; from sandy soil, larger and yellower; picked October 11, 1902, stored October 13; May 1, 1903, in prime commercial condition, no scald or decay.

Massachusetts Agricultural College Experiment Station, Amherst, Hampshire County, Mass.: Dull green, No. 2, covered with "flyspeck" fungus; picked October 8, 1902, stored October 12; in commercial condition until February 1, 1903, when the fruit began to mellow and grow mealy, while very green outside.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Hard, sound, No. 1; picked October 3, 1902, stored October 11; in good commercial condition until March 15, 1903, when the fruit began to discolor and soften. Fruit picked in 1901 kept in similar condition until the middle of March, 1902, except for the appearance of considerable scald.

George T. Powell, Ghent, Columbia County, N. Y.: Bright, well colored, No. 1; picked October 5, 1902, stored October 9; in good commercial condition until May 1, 1903, when the scald began to appear.

Rhode Island Greening. (See Rhode Island.)

Rhodes.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Poorly colored, No. 1; picked October 1 to 12, 1901, stored October 25; in prime condition till April 1, 1902, after which it became mellow; in good condition for box storage till May 1; no scald; picked September 22, 1902, stored September 27; mellow by January 15, 1903.

Rhodes Orange. (See Rhodes.)

Richardson's Red. (See Beach.)

Rome.

A. A. Boggs, Waynesville, Haywood County, N. C.: Large, dark red, No. 1; picked September 15, 1902, stored September 26; March 1, 1903, firm, no scald or rot.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Hard, light colored, No. 1; picked November 5, 1902, stored November 15; March 14, 1903, firm and sound. Fruit picked in 1901 in good commercial condition until May 1, 1902.

Rome—Continued.

G. E. Spohr, Manhattan, Riley County, Kans.: Small, poorly colored; dates of picking and storing undetermined; March 20, 1902, considerably shriveled, but free from rot and scald.

Rome Beauty. (See Rome.)

Roxbury.

F. L. Bradley, Barker, Niagara County, N. Y.: Sound, No. 1; picked October 1, 1902, stored October 3; in good commercial condition until May 1, 1903, aside from slight shriveling.

J. E. Brown, Wilson, Niagara County, N. Y.: No. 1; dates of picking and storing undetermined; May 1, 1902, in prime commercial condition, no shriveling, free from rot.

Massachusetts Agricultural College Experiment Station, Amherst, Hampshire County, Mass.: Medium sized, green, not well russeted; picked October 13, 1902, stored October 15; May 1, 1903, in good commercial condition, no rot, some wilting.

W. S. Miller, Gerrardstown, Berkeley County, W. Va.: No. 1; picked November 4, 1901, stored November 12; May 1, 1902, in prime commercial condition, no wilting, free from rot.

New York State Experiment Station, Geneva, Ontario County, N. Y.: No. 1; picked October 24, 1902, stored November 15; May 1, 1903, firm, no decay. Fruit picked in 1901 kept in similar condition.

George T. Powell, Ghent, Columbia County, N. Y.: Large, bright, No. 1; picked October 16, 1902, stored October 19; in prime commercial condition until May 1, 1903.

Virginia Agricultural Experiment Station, Blacksburg, Montgomery County, Va.; Bright, No. 1; picked September 26, 1901, stored October; May 1, 1902, in prime commercial condition, no wilting or decay.

Roxbury Russet. (See Roxbury.)

Salome.

W. S. Miller, Gerrardstown, Berkeley County, W. Va.: Large, bright, highly colored, No. 1; picked October 9, 1901, stored October 18; semifirm January 1, 1902, but held in prime condition till May 1, when scald appeared and the fruit mellowed.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Hard, medium sized, light colored; picked October 12, 1902, stored October 21; in good condition till April 1, 1903, when scald appeared freely; June 1, still hard, but all scalded.

Scarlet Cranberry.

Massachusetts Agricultural Experiment Station, Amherst, Hampshire County, Mass.: Medium to small, very hard, dull colored; picked October 13, 1902, stored October 15; May 1, 1903, hard, no scald or rot; would probably have kept much longer.

W. S. Miller, Gerrardstown, Berkeley County, W. Va.: Large, bright, well colored, No. 1; picked October 12, 1901, stored October 18; May 1, 1902, hard, bright, no scald or decay; would probably have kept much longer.

Scott Winter. Synonym: *Scott's Red Winter.*

New York State Experiment Station, Geneva, Ontario County, N. Y.: No. 1; picked October 12, 1901, stored October 21; May 1, 1902, sound, firm, but slightly wilted; no scald.

Scott's Red Winter. (See Scott Winter.)

Seeknofurther. (See Westfield.)

Senator. (See OLIVER.)

Sharp.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Small, hard, immature; picked October 12, 1901, stored October 21; firm till January 15, 1902; semifirm till March 15, after which scald appeared and the fruit softened.

Shiawassee. Synonym: *Shiawassee Beauty.*

Massachusetts Agricultural College Experiment Station, Amherst, Hampshire County, Mass.: Well colored, fair grade; picked October 13, 1902, stored October 15; firm till December 1, 1902, after which it softened and later burst open.

Shiawassee Beauty. (See SHIAWASSEE.)

Smith. Synonym: *Smith Cider.*

A. A. Boggs, Waynesville, Haywood County, N. C.: Large, bright, light colored, No. 1; picked September 25, 1902, stored September 30; firm till December 1, 1902, after which it softened and decayed badly.

H. M. Dunlap, Southern Illinois: Well colored, medium sized, No. 1; picked September 9, 1901, stored September 15; December 1, 1902, semifirm; in good box condition till February 1, 1902, after which scald appeared.

G. E. Spohr, Manhattan, Riley County, Kans.: Light colored, No. 1; picked October 3, 1901, stored October 12; in good commercial condition till February 15, 1902, after which scald appeared and the fruit mellowed.

Smith Cider. (See SMITH.)

Snow. (See FAMEUSE.)

Spitzenburg. (See ESOPUS.)

Spohr.

G. E. Spohr, Manhattan, Riley County, Kans.: Well colored, No. 1; picked October 3, 1901, stored October 12; hard and in prime commercial condition March 20, 1902, and apparently would have kept well throughout storage season; no rot or scald. The fruit received under this name appears to be Missouri Pippin.

Springdale.

W. S. Miller, Gerrardstown, Berkeley County, W. Va.: Large, well colored, No. 1; picked November 5, 1901, stored November 12; hard and in prime condition throughout storage season; removed from storage June 14, 1902, still hard and of bright color, no rot or scald; a long keeper.

Stanard.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Highly colored, No. 1; picked October 12, 1901, stored October 21; good commercial barrel condition till April 1; semifirm and in good box condition till May 1, 1902; no scald or rot; picked September 19, 1902, stored September 27; mellow after March 1, 1903.

Stark.

Maine Agricultural Experiment Station, Orono, Penobscot County, Me.: Large, well colored, bright, No. 1; picked October 7, 1901, stored October 14; in prime commercial condition June 14, 1902, when removed from storage; no scald or decay.

W. S. Miller, Gerrardstown, Berkeley County, W. Va.: Medium sized, hard, fair colored, No. 1; picked October 2, 1901, stored October 8; scald appeared after April 1, 1902, but fruit remained hard throughout storage season.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Hard, greenish red, No. 1; picked October 12, 1901, stored October 21; hard with no scald or decay June 6, 1902, when removed from storage.

Stayman. (See STAYMAN WINESAP.)

Stayman Winesap. Synonym: *Stayman.*

A. A. Boggs, Waynesville, Haywood County, N. C.: Fancy, dark red, bright, large, No. 1; picked October 25, 1902, stored November 26; overripe from delay on entering storage; 25 per cent decayed January 1, 1903; no scald.

S. H. Derby, Woodside, Kent County, Del.: Well colored, considerable injury from codling moth; picked September 29, 1902, stored October 1; May 1, 1903, in prime commercial condition, firm, no scald or rot.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Medium sized, rather dull colored, No. 1; picked October 1 to 12, 1901, stored October 21; in good condition till April 1, 1902, when the fruit began to scald; May 1, 65 per cent scalded, balance of fruit still hard.

Steele's Red Winter. (See Red Canada.)

Strode. Synonym: *Strode's Birmingham.*

New York State Experiment Station, Geneva, Ontario County, N. Y.: Small, greenish yellow; picked September 20, 1902, stored September 27; in good condition till December 15, 1902, after which the skin cracked open, while the fruit was still firm.

Strode's Birmingham. (See Strode.)

Stuart Golden.

W. S. Miller, Gerrardstown, Berkeley County, W. Va.: Bright, hard, No. 1; picked October 11, 1901, stored October 18; in prime commercial condition, hard, bright, no scald or rot, June 14, 1902, when taken from storage.

Sutton. Synonym: *Sutton Beauty.*

Massachusetts Agricultural College Experiment Station, Amherst, Hampshire County, Mass.: Medium sized, bright, dark red, No. 1; picked October 8, 1902, stored October 12; firm for barrel storage till February 1, 1903; semifirm and in good condition for box storage till March 15, 1903, after which the fruit became mellow; no scald or rot.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Medium sized, well colored, but rather dull, No. 1; picked October 21, 1902, stored October 27; firm for barrel storage till March 15, 1903; in good condition for box storage till April 15, 1903.

George T. Powell, Ghent, Columbia County, N. Y.: Fancy, large, bright, dark red, from young trees; picked October 6, 1902, stored October 9; firm for barrel storage till February 1, 1903; semifirm and in good condition for box storage till March 1, after which the flesh softened and became mealy; no rot or scald.

This variety does not keep as long as Baldwin from the same orchards.

Sutton Beauty. (See Sutton.)

Swaar.

Near Kansas Agricultural College, Manhattan, Riley County, Kans.: Clean, No. 1; picked October 9, 1901, stored October 13; March 20, 1902, firm, no scald or rot.

Massachusetts Agricultural College Experiment Station, Amherst, Hampshire County, Mass.: Dull colored, fair, No. 1; picked October 8, 1902, stored October 12; May 1, 1903, firm, no rot or scald.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Hard, green, No. 1; picked October 12, 1901, stored October 21; May 1, 1902, firm, no decay, scald slight.

George T. Powell, Ghent, Columbia County, N. Y.: Bright, greenish yellow, No. 1; picked October 13, 1902, stored October 19; May 1, 1903, in prime market condition, no scald or rot.

Talman Sweet. (See Tolman.)

Texas. Synonym: *Pride of Texas.*

New York State Experiment Station, Geneva, Ontario County, N. Y.: Small, hard, and green; picked October 12, 1901, stored October 21; May 1, 1902, firm, no rot, considerable scald.

Titovka.

Michigan Agricultural College Experiment Substation, South Haven, Van Buren County, Mich.: Large, well colored, No. 1; picked August 21, 1902, stored September 3; September 16, 1902, fully ripe and highly colored; November 14, overripe; many fruits cracked open and flesh discolored.

Titus. Synonym: *Titus Pippin.*

New York State Experiment Station, Geneva, Ontario County, N. Y.: Hard, green, No. 1; picked October 6, 1902, stored October 11; May 1, 1903, firm, no decay or scald.

Titus Pippin. (See Titus.)

Tolman. Synonyms: *Tolman Sweet; Talman Sweet.*

F. L. Bradley, Barker, Niagara County, N. Y.: Fair, No. 1; picked October 9, 1902, stored October 15; May 1, 1903, firm, no decay or scald.

Z. A. Gilbert, Farmington, Franklin County, Me.: Fair, No. 1; picking date undetermined, stored November 14, 1902; May 1, 1903, hard, no decay or scald.

G. G. Hitchings, South Onondaga, Onondaga County, N. Y.: Bright, clear yellow, No. 1; trees 40 years old; picked October 1, 1902, stored October 4; May 1, 1903, firm, no decay or scald; fruit picked in 1901 kept in similar condition.

Massachusetts Agricultural College Experiment Station, Amherst, Hampshire County, Mass.: Bright, No. 1; picked September 30, 1902, stored October 3; began to mellow after March 1, 1903; no scald or rot.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Small, hard, No. 1; picked September 27, 1902, stored October 1; May 1, 1903, firm, no decay, scald slight.

Tolman Sweet. (See Tolman.)

Tompkins King. Synonym: *King.*

F. L. Bradley, Barker, Niagara County, N. Y.: Well colored, No. 1; picked October 9, 1902, stored October 15; in good commercial condition until April 15, 1903, after which the fruit became mellow.

J. E. Brown, Wilson, Niagara County, N. Y.: Well colored, No. 1; picked October 9, 1901, stored October 17; April 9, 1902, in good commercial condition, decay slight, no scald; commercial limit May 1.

G. G. Hitchings, South Onondaga, Onondaga County, N. Y.: Large, dark red, No. 1; trees 13 years old; picked October 5, 1901, stored October 12; May 1, 1902, firm, no scald or rot; fruit packed in 1902 did not keep later than April 1, 1903.

Massachusetts Agricultural College Experiment Station, Amherst, Hampshire County, Mass.: Medium sized, bright, half colored; picked September 30, 1902, stored October 3; May 1, 1903, firm, no rot or scald.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Small, hard, and green; picked September 23, 1902, stored September 27; May 1, 1903, green and hard, no decay or scald; fruit picked in 1901 kept in sound condition until May 1, 1902.

George T. Powell, Ghent, Columbia County, N. Y.: Very large, well colored, No. 1, from young, rank-growing trees; picked October 4, 1902, stored October 9; held well until January 1, 1903, when the fruit began to soften and become mealy.

Tufts. Synonym: *Tufts Baldwin.*

New York State Experiment Station, Geneva, Ontario County, N. Y.: Hard, greenish red, No. 1; picked September 16, 1902, stored September 27; March 14, 1903, firm and sound; May 1, softening, no rot, scald slight.

Tufts Baldwin. (See TUFTS.)

Twenty Ounce. Synonym: *Cayuga Redstreak.*

G. G. Hitchings, South Onondaga, Onondaga County, N. Y.: Large, well colored, No. 1; trees 12 years old; dates of picking and storing undetermined; January 15, 1902, ripe, but still firm and sound.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Well colored, No. 1; picked September 25, 1902, stored September 29; January 6, 1903, mellow, commencing to decay. Fruit picked in 1901 kept well until February 1, 1902.

Vanhoy.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Hard, green, fair, No. 1; picked October 12, 1901, stored October 21; May 1, 1902, firm, no rot, considerable scald.

Via.

Virginia Agricultural Experiment Station, Blacksburg, Montgomery County, Va.: Clean, No. 1; picked September 26, 1901, stored October 18; May 1, 1902, semi-firm, no decay or scald; good commercial condition for storage in boxes.

Victoria Sweet.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Well colored, No. 1; picked October 12, 1901, stored October 21; January 10, 1902, beautifully colored, quite mellow.

Wagener.

G. G. Hitchings, South Onondaga, Onondaga County, N. Y.: Fair, No. 1; picked October 1, 1902, stored October 4; began scalding February 1, 1903, and by March 15 over 50 per cent of the fruit was scalded; commercial limit about February 1 on account of scald.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Hard, well colored, No. 1; picked November 5, 1902, stored November 15; March 14, firm, no decay or scald; May 1, 1903, soft, considerable decay, no scald.

George T. Powell, Ghent, Columbia County, N. Y.: Half red, No. 1; picked October 16, 1902, stored October 19; held in prime condition until April 1, 1903; no rot or scald; after February 1 the light side of the fruit would scald badly within forty-eight hours after removal from storage.

This variety unless highly colored is one of the worst to scald after midwinter.

Walbridge.

G. G. Hitchings, South Onondaga, Onondaga County, N. Y.: Large, well colored, No. 1; picked October 7, 1902, stored October 12; in good commercial condition until February 1, 1903, when scald began to develop. Fruit picked in 1901 kept in similar condition. Commercial limit February 1 to 15.

Maine Agricultural Experiment Station, Orono, Penobscot County, Me.: Hard, medium sized, No. 1; picked October 7, 1901, stored October 24; March 11, 1902, firm, no scald or rot; commercial limit May 1, after which scald and decay appeared.

Massachusetts Agricultural College Experiment Station, Amherst, Hampshire County, Mass.: Hard, poorly colored, fair, No. 1; picked October 13, 1902, stored October 15; May 1, 1903, hard, no rot or scald.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Hard, green, fair, No. 1; picked October 12, 1901, stored October 21; after March 15, 1902, the fruit softened and much of it became mealy.

This variety often ripens unevenly and becomes mealy and discolored in flesh while the skin is bright in color.

Washington Royal. Synonym: *Palmer Greening.*

Massachusetts Agricultural College Experiment Station, Amherst, Hampshire County: Bright, clear yellow, No. 1; picked October 8, 1902, stored October 12; in good commercial condition until January 1, 1903, when the fruit began to soften; in good condition for storage in boxes till February 1.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Small, hard, and green; picked October 3, 1902, stored October 11; April 30, 1903, mellow, no rot or scald; commercial limit March 1; fruit softens without developing yellow color.

Washington Strawberry.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Light colored, No. 1; picked October 12, 1901, stored October 21; January 10, 1902, mellow, no scald or rot; commercial limit December 1, 1901.

Wealthy.

G. G. Hitchings, South Onondaga, Onondaga County, N. Y.: Large, dark red, No. 1; picked September 20, 1902, stored September 24; in prime commercial condition until January 1, 1903, after which it began to soften and fade in color. Fruit picked in 1901 kept in similar condition.

E. Hutchins, Fennville, Allegan County, Mich.: Light colored, No. 1; picked August 28, 1902, stored September 2; November 14, 1902, in prime commercial condition, free from rot and scald; would have kept well for a number of weeks longer.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Small, hard, and immature; picked September 18, 1902, stored September 27; March 14, 1903, semifirm, decay slight, no scald.

Western Beauty.

New York State Experiment Station, Geneva, Ontario County, N. Y.: No. 1; picked October 12, 1901, stored October 21; May 1, 1902, firm, no rot or scald.

Westfield. Synonym: *Seeknofurther.*

G. G. Hitchings, South Onondaga, Onondaga County, N. Y.: Large, well colored, No. 1; picked October 1, 1902, stored October 5; May 1, 1903, firm, no rot or scald. Fruit picked in 1901, not so well colored, kept in similar condition.

Massachusetts Agricultural College Experiment Station, Amherst, Hampshire County, Mass.: Large, greenish, No. 1; picked October 8, 1902, stored October 12; May 1, 1903, hard, no rot or scald.

George T. Powell, Ghent, Columbia County, N. Y.: Medium sized, half colored; picked October 6, 1902, stored October 9; May 1, 1903, firm, no rot or scald.

White Doctor.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Small, greenish yellow; picked September 20, 1902, stored September 27; March 14, 1903, semifirm, decay slight, all scalded slightly. Fruit picked in 1901 kept in similar condition. Commercial limit February 1.

White Pippin.

A. A. Boggs, Waynesville, Haywood County, N. C.: Bright, large, No. 1; picked September 18, 1902, stored September 25; May 1, 1903, firm, no rot, scald light on a few; commercial limit April 15.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Sound, No. 1; picked October 6, 1902, stored October 11; March 14, 1903, firm, no scald; commercial limit April 15; fruit picked in 1901 after March 1, 1902, softened rapidly and decayed.

White Pearmain. Synonym: *White Winter Pearmain.*

Near Kansas Agricultural College, Manhattan, Riley County, Kans.: Small, immature; picked October 16, 1901, stored October 19; May 1, 1902, hard, no rot or scald.

White Winter Pearmain. (See WHITE PEARMAIN.)

Willow. Synonym: *Willowtwig.*

H. M. Dunlap, Savoy, Ill.: No. 1; picked October 10, 1901, stored October 15; March 18, 1902, firm, slightly injured by scald and rot.

Virginia Agricultural Experiment Station, Blacksburg, Montgomery County, Va.: No. 2; cloudy and wormy; picked September 20, 1901; date of storing undetermined; May 1, 1902, commencing to shrivel, no scald, decay slight.

Willowtwig. (See WILLOW.)

Winesap.

S. H. Derby, Woodside, Kent County, Del.: Hard, light red, No. 1; picked September 29, 1902, stored September 31; May 1, 1903, hard, no scald or rot; in prime condition to carry for many weeks.

G. J. Dodd, Greenwood, Jackson County, Mo.: Well colored, No. 1; picked October 1, 1901, stored October 4; March 10, 1903, in prime commercial condition, no rot, scald very slight; commercial limit, on account of scald, March 15.

H. M. Dunlap, Savoy, Champaign County, Ill.: No. 1; slightly wormy; picked October 23, 1901, stored October 28; January 17, 1902, sound and in good commercial condition; March 18, firm, no scald, decay slight; fruit picked two weeks earlier and lighter in color was one-third scalded.

G. G. Hitchings, South Onondaga, Onondaga County, N. Y.: Small, hard, dark red; trees 6 years old; picked October 13, 1902, stored October 16; kept well until March 1, 1903, when scald began to develop. Fruit picked in 1901 kept in similar condition. Hard throughout storage season.

Near Kansas Agricultural College, Manhattan, Riley County, Kans.: Hard, small, poorly colored; picked October 4, 1901, stored October 10; March 20, 1902, hard, no rot or scald; commercial limit probably April 15.

S. L. Lupton, Winchester, Frederick County, Va.: Fair, No. 1; color fair; somewhat cloudy and wormy; picked October 18, 1901, stored October 22; March 27, 1902, firm, decay very slight, about one-third scalded.

Ozark Orchard Company, Goodman, McDonald County, Mo.: Well colored, No. 1; picked October 8, 1902, stored October 13; March 10, 1903, firm, no scald, 20 per cent of rot; commercial limit February 1.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Hard, small, light colored; picked October 12, 1901, stored October 21; March 14, 1902, firm, no decay or scald; April 30, about 75 per cent of scald, no decay, hard.

Virginia Agricultural Experiment Station, Blacksburg, Montgomery County, Va.: Medium sized, fair, No. 1; picked September 30, 1901, stored October 17; May 1, 1902, firm, no scald, very slight decay, and wilting.

Winter Maiden Blush. (See GREENVILLE.)

Winter Paradise. Synonym: *Winter Sweet Paradise.*

W. S. Miller, Gerrardstown, Berkeley County, W. Va.: No. 1; dates of picking and storing undetermined; May 27, 1902, in prime commercial condition, no rot or scald.

Winter Streifling.

Michigan Agricultural College Experiment Substation, South Haven, Van Buren County, Mich.: Light colored, No. 1; picked September 1, 1902, stored September 3; November 14, 1902, hard and sound; would have kept a number of weeks longer.

Winter Sweet Paradise. (See WINTER PARADISE.)

Wolf River.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Large, bright, No. 1; picked September 25, 1902, stored September 27; January 6, 1903, in prime commercial condition, no rot or scald.

Yellow Bellflower. Synonym: *Bellflower.*

F. L. Bradley, Barker, Niagara County, N. Y.: No. 2 grade, scabby and russeted; picked October 9, 1902, stored October 15; May 1, 1903, semifirm and free from scald and decay.

G. T. Powell, Ghent, Columbia County, N. Y.: Highly colored, No. 1; picked October 9, 1902, stored October 13; April 1, 1903, beginning to mellow, no scald or rot.

Yellow Newtown. Synonyms: *Albemarle; Newtown Pippin; Yellow Newtown Pippin.*

S. L. Lupton, Winchester, Frederick County, Va.: Medium sized, well colored, wormy; picked October 7, 1901, stored October 10; May 1, 1902, firm, decay and scald slight; commercial limit April 1.

W. S. Miller, Gerrardstown, Berkeley County, W. Va.: Bright, No. 1; picked October 10, 1901, stored October 18; June 14, 1902, in prime commercial condition, no scald or decay.

Virginia Agricultural Experiment Station, Blacksburg, Montgomery County, Va.: Somewhat wormy; picked September 27, 1901, stored October 17; June 14, 1902, firm, color and quality good; decay and scald slight; commercial limit May 15.

Yellow Newtown Pippin. (See Yellow Newtown.)

York Imperial. Synonym: *Johnson's Fine Winter.*

A. A. Boggs, Waynesville, Haywood County, N. C.: Hard, bright, half colored, No. 1; picked September 18, 1902, stored September 25; May 1, 1903, firm, no scald or decay.

S. L. Lupton, Winchester, Frederick County, Va.: Medium grade, greenish red, considerable codling moth; picked October 4, 1901, stored October 12; scalded badly after January 1, 1902; fruit picked October 23, dark red, began to scald after February 1, but did not scald as badly as the early picked fruit; the commercial limit of the dark fruit was six weeks longer.

New York State Experiment Station, Geneva, Ontario County, N. Y.: Medium to small, light colored, very hard; picked October 1–12, 1901, stored October 21; began to scald February 15, 1902, and a month later three-fourths of the fruit was lightly scalded on the green side; remained firm throughout season; commercial limit February 15 to March 15.

Ozark Orchard Company, Goodman, McDonald County, Mo.: Large, well colored, No. 1; picked October 8, 1902, stored October 13; March 10, 1903, overripe, somewhat shriveled, one-third of the fruit decayed, no scald; commercial limit January 15.

Virginia Agricultural Experiment Station, Blacksburg, Montgomery County, Va.: Bright, well colored, No. 1; picked September 26, 1901, stored October 17; January 24, 1902, firm, no decay, one-third of the fruit slightly scalded; commercial limit January 1.

F. Wellhouse, Tonganoxie, Leavenworth County, Kans.: Two-thirds colored; picked October 8, 1901, stored October 12; March 20, 1902, slightly wilted, some decay, one-fourth of the fruit scalded; commercial limit February 15.

York Stripe.

W. S. Miller, Gerrardstown, Berkeley County, W. Va.: Fair, No. 1; picked October 7, 1901, stored October 18; May 27, 1902, firm, slight decay, and scald; commercial limit May 1.

Zolotoreff.

Michigan Agricultural College Experiment Substation, South Haven, Van Buren County, Mich.: Large, well colored, No. 1; picked August 24, 1902, stored September 3; September 16, 1902, mellow, no rot or scald; November 14, appearance of fruit quite good, but flesh dry, discolored, and tasteless.

SUMMARY.

An apple usually should be fully grown and highly colored when picked, to give it the best keeping and commercial qualities. When harvested in that condition it is less liable to scald, of better quality, more attractive in appearance, and is worth more money than when it is picked in greener condition. (See pp. 16–18.)

An exception to the statement appears to exist in the case of certain varieties when borne on rapidly growing young trees. Such fruit is likely to be overgrown, and under these conditions the apples may need picking before they reach their highest color and full development. (See pp. 17, 23, 24.)

Uniform color may be secured by pruning to let the sunlight into the tree, by cultural conditions that check the growth of the tree early in the fall, and by picking over the trees several times, taking the apples in each picking that have attained the desired degree of color and size. (See pp. 18, 19.)

Apples should be stored as quickly as possible after picking. The fruit ripens rapidly after it is picked, especially if the weather is hot. The ripening which takes place between the time of picking and storage shortens the life of the fruit in the storage house. The fruit rots multiply rapidly if storage is delayed and the fruit becomes heated. If the weather is cool enough to prevent after-ripening, a delay in the storage of the fruit may not be injurious to its keeping quality. (See pp. 19, 21.)

A temperature of 31° to 32° F. retards the ripening processes more than a higher temperature. This temperature favors the fruit in other respects. (See pp. 21, 22.)

A fruit wrapper retards the ripening of the fruit; it preserves its bright color, checks transpiration and lessens wilting, protects the apple from bruising, and prevents the spread of fungous spores from decayed to perfect fruit. In commercial practice the use of the wrapper may be advisable on the finest grades of fruit that are placed on the market in small packages. (See pp. 22, 23.)

Apples that are to be stored for any length of time should be placed in closed packages. Fruit in ventilated packages is likely to be injured by wilting. Delicate fruit and fruit on which the ripening processes need to be quickly checked should be stored in the smallest practicable commercial package. The fruit cools more rapidly in small packages. (See pp. 24, 25.)

Apples should be in a firm condition when taken from storage, and kept in a low temperature after removal. A high temperature hastens decomposition and develops scald. (See pp. 25, 26.)

The best fruit keeps best in storage. When the crop is light it may pay to store fruit of inferior grade, but in this case the grades should be established when the fruit is picked. The bruising of the fruit leads to premature decay. (See p. 26.)

The scald is probably caused by a ferment or enzyme which works most rapidly in a high temperature. Fruit picked before it is mature is more susceptible than highly colored, well-developed fruit. (See pp. 26–28.)

After the fruit is picked its susceptibility to scald increases as the ripening progresses. (See pp. 28, 29.)

The ripening that takes place between the picking of the fruit and its storage makes it more susceptible to scald, and delay in storing the fruit in hot weather is particularly injurious. (See pp. 30, 31.)

The fruit scalds least in a low temperature. On removal from storage late in the season the scald develops quickly, especially when the temperature is high. (See pp. 29, 30.)

It does not appear practicable to treat the fruit with gases or other substances to prevent the scald. (See pp. 32, 33.)

From the practical standpoint the scald may be prevented to the greatest extent by producing highly colored, well-developed fruit, by storing it as soon as it is picked in a temperature of 31° to 32° F, by removing it from storage while it is still free from scald, and by holding it after removal in the coolest possible temperature. (See pp. 26–31.)

A variety may differ in its keeping quality when grown in different parts of the country. It may vary when grown in the same locality under different cultural conditions. The character of the soil, the age of the trees, the care of the orchard—all of these factors modify the growth of the tree and fruit and may affect the keeping quality of the apples. The character of the season also modifies the keeping power of the fruit. (See pp. 33–62.)

PLATES.

DESCRIPTION OF PLATES.

PLATE I. Frontispiece. Apple scald. The upper figure shows a light-colored York Imperial apple in March, 1903, with scald, which develops first and most severely on the least mature side of the fruit. The lower figure shows a highly colored York Imperial apple picked from the same tree at the time (October, 1902) when the upper specimen was picked. A trace of scald is shown on the right-hand side of the apple, where the color is not so dark as elsewhere.

Highly colored fruit is less susceptible to scald than fruit picked in an immature condition.

PLATE II. Tompkins King apples, February, 1903. This fruit was picked at two degrees of maturity in September, 1902, from young, rapidly growing trees. The upper specimen represents fruit that was highly colored but firm when picked; the lower figure shows fruit one-half to two-thirds colored. The less mature fruit kept in good condition a month longer than the highly colored apple. These apples were overgrown—a condition likely to occur on young trees.

From older trees, apples that are fully grown, highly colored, and firm when picked have kept as well in all cases (and better in many) than immature and undercolored fruit. The dark-colored York Imperial apples from older trees represented by the lower figure in Plate I, frontispiece, have longer-keeping qualities than the less mature fruit shown in the upper figure.

PLATE III. Methods of wrapping and packing apples. Fig. 1.—Apples unwrapped and in tissue, parchment, and wax wrappers, in order from left to right.

The wrapper retards the ripening of the fruit, preserves its bright color, checks transpiration, lessens wilting, protects the apple from bruising, and prevents the spread of fungous spores from decayed to perfect fruit.

Fig. 2.—Well packed barrel of Esopus *Spitzenburg* apples removed from storage in March, 1903. The fruit was properly packed in the orchard and repacking was not needed when the fruit was sold.

Fig. 3.—"Slack" packed barrel of Northern Spy apples removed from storage in March, 1903. The fruit was not packed firmly in the orchard. It settled in the barrel, leaving it "slack" when removed from storage. Barrels in this condition need to be repacked. The fruit is easily bruised and it deteriorates more quickly in the storage house and after removal when it is loosely packed.

PLATE IV. Baldwin apples from clay and from sandy soils, May 1, 1903. This fruit was picked in the same orchard in October, 1902, and was stored soon after picking at a temperature of 32° F. The fruit from the heavy clay soil represented by the upper figure was generally smaller and was much less highly colored. Both lots kept well throughout the storage season. The fruit from the sandy land represented in the lower figure was riper at the end of the storage season, better in quality, and worth more to the dealer and to the consumer.

PLATE V. Scald on Rhode Island *Greening* apple. The cross section shows that the scald is a surface trouble and does not extend into the flesh.

PLATE VI. Wagener apple. The upper figure represents the condition of the fruit when removed from storage in February, 1903, it having been picked in October, 1902, and stored at a temperature of 32° F. There was no scald on the apples when removed. Forty-eight hours later, after the fruit had been in a temperature of 70° F., the light-colored portion of the apples was badly scalded, as shown in the lower figure.

Late in the storage season the fruit is more susceptible to scald, and a high temperature when the fruit is removed from the storage house may develop it quickly.

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TOMPKINS KING APPLES. OVERGROWN ON YOUNG TREES.

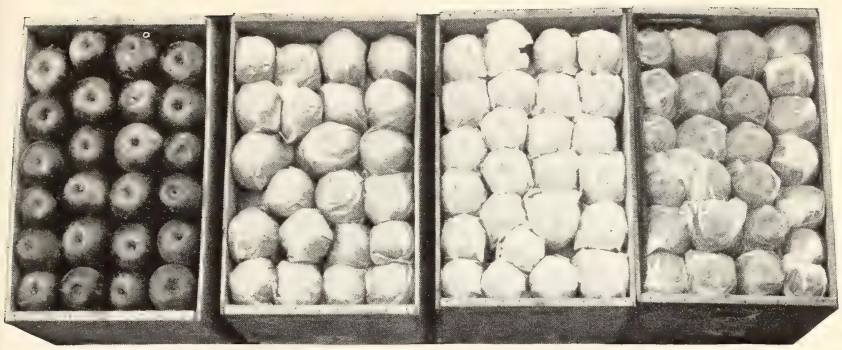


FIG. 1.—APPLES UNWRAPPED AND IN TISSUE, PARCHMENT, AND WAX WRAPPERS.

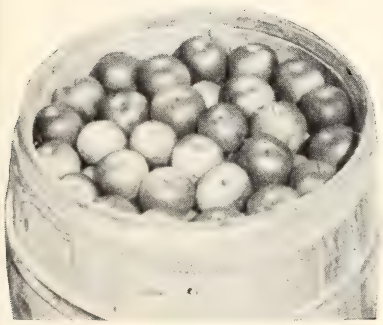


FIG. 2.—WELL PACKED ESOPUS SPITZENBURG APPLES, REMOVED FROM STORAGE IN MARCH.

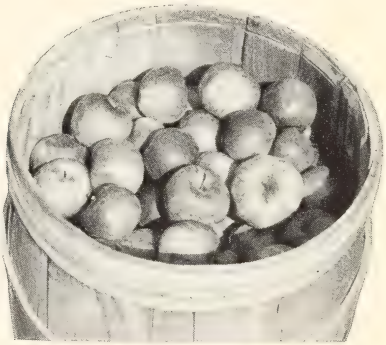
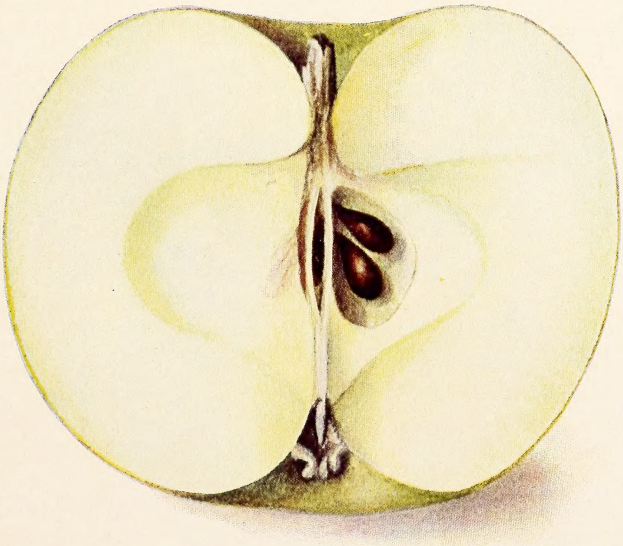


FIG. 3.—"SLACK" PACKED NORTHERN SPY APPLES, REMOVED FROM STORAGE IN MARCH.

METHODS OF WRAPPING AND PACKING APPLES.

BALDWIN APPLES.

UPPER FIGURE FROM CLAY SOIL; LOWER FIGURE FROM SANDY SOIL.



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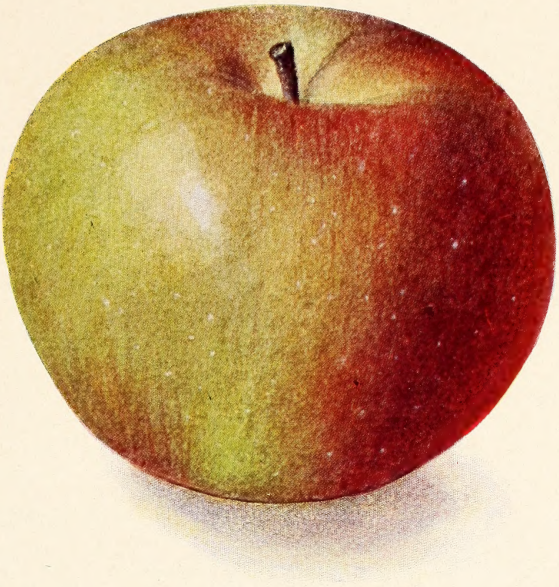
SCALD ON RHODE ISLAND GREENING APPLE.



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WAGENER APPLE.

LOWER FIGURE, SCALD DEVELOPED AFTER REMOVAL FROM STORAGE HOUSE.